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कर्नाटक राज्य के उत्तर कन्नडा और शिमोगा जिले में भूआकृति संख्या 48I/12, 48I/16, 48J/13 और 48J/14 के कुछ हिस्सों में वृहद पैमाने पर (१: ५०,०००) भूस्खलन संवेदनशीलता का मानचित्रण

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(कार्यसत्र: २०१९-२०)

MACRO-SCALE (1:50,000) LANDSLIDE SUSCEPTIBILITY MAPPING IN PARTS OF TOPOSHEET NOS. 48I/12, 48I/16, 48J/13 AND 48J/14, UTTAR KANNADA AND SHIMOGA DISTRICTS, KARNATAKA

(FSP CODE NO: M4LSSM/NC/SR/SU-KG/2019/27979)
(FIELD SEASON: 2019-20)

फील्ड सीजन 2019-20 के लिए अंतिम प्रतिवेदन
Final report for field season 2019-20

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MACRO-SCALE (1:50,000) LANDSLIDE SUSCEPTIBILITY MAPPING IN PARTS OF TOPOSHEET NOS. 48I/12, 48I/16, 48J/13 and 48J/14, UTTARA KANNADA AND SHIMOGA DISTRICTS, KARNATAKA.

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Macro-Scale (1:50,000) Landslide Susceptibility Mapping In Parts Of Toposheet Nos. 48I/12, 48I/16, 48J/13 And 48J/14, Uttara Kannada And Shimoga Districts, Karnataka.

Abstract

In accordance with the Annual Programme of GSI for FS 2019-20, Macro scale Landslide Susceptibility Mapping was carried for 1577 sq.km in parts of toposheet no 48I/12, 48I/16, 48J/13 and J/14 around Sirsi, Ambikanagar and Dandeli villages in parts of Uttar Kannada and Shimoga districts of Karnataka, vide item number M4LSSM/NC/SR/SU-KG/2019/27979 out to generate a landslide susceptibility map using high resolution remote sensing data accompanied by field inputs.

Along the Western Ghats, as most of the landslides are cut slope failures, the thematic maps used were geomorphology, LULC, Slope forming material, regolith thickness and slope morphometry maps, which were prepared using Google Earth Multi temporal satellite imageries and CARTOSAT DEM data and validated in field.

The area forms a part of the Western Ghats and is marked by an undulating terrain. The northern part of the area, near Dandeli and Ambikanagara comprises a hilly terrain with thick forest cover. The terrain is rugged with innumerable low mounds and moderately dissected ridges. The valleys are narrow with small isolated cultivated patches. The southern part of the area near Sirsi is a more or less flat country, with few isolated hills, forming a plateau region. Extensive cultivation is present in the area, with settlements in the vicinity of the cultivated patches. The drainage pattern in the area is mainly dendritic to sub-dendritic. Along the ridge slopes trellis and sub parallel drainage pattern are observed. Tropical climate aided by incessant rainfall had aided in intense weathering and soil formation in the area. As the slopes are gentle, insitu soil formation supports lush vegetative growth as well. Transported soil is mainly restricted to the banks of river channels.

The area exposes lithounits of Archean- mainly Sargur Group, Peninsular Gneissic Complex and Dharwar Supergroup, Palaeoproterozoic Younger Intrusives and Laterites of Cenozoic age. The Dharwar Supergroup of rocks pertaining to Shimoga belt is exposed overlying the basement granite gneiss of Peninsular Gneissic Complex.

122 landslides were demarcated in field during the course of fieldwork. All the landslides were triggered by incessant rains from the southwest monsoon during the months of July to

October, 2019. The slides were mostly along cut slopes meant for transportation corridors or for the purpose of agriculture. Most of the slides are earth and debris slides, with a very shallow slip plane and caused by shallow translational failure. The rock slides observed were mainly along highly jointed meta-argillite, where three joint sets were predominant.

There were two major causative factors for the slides- Toe erosion by stream flows along the base of the slope and the second being unscientific cut slopes for roads, settlements and cultivation. Stream shifting is also rampant in the area, where over a period of years, streams are shifted to either bank to facilitate cultivation.

The landslide susceptibility map was generated using the various thematic map that divides the areas into zone based on the relative susceptibility. Only 2% of the area falls under the highly susceptible class which is mostly restricted to transportation corridors and areas adjoining extensive cut slopes. Almost 81% (1279 sq.km) of the area falls under the low landslide susceptibility zone. 17% of the area comes under the moderate susceptibility zone. When compared with the number of landslides, most of the landslides are observed within the low susceptibility zone, indicating that landscape changes due to human interference is a major reason for slope failure. The area influenced by landslides is highest for the high susceptibility zone indicating that the high susceptible zone, even though limited in area, is quite vulnerable.

कर्नाटक राज्य के उत्तरा कन्नड़ और शिमोगा जनपदों की टोपोशीट संख्याओं के 48 आई/12, 48 आई/16, और 48 जे/13 के भागों में स्थूल पैमाने (1:50,000) पर भूस्खलन संवेदंशीलता मानचित्रण

सारांश

कार्यसत्र 2019-20 के लिए GSI के वार्षिक कार्यक्रम के अनुसार, को के लिए टोपोशीट संख्याओं के 48 आई/12, 48 आई/16, और 48 जे/13 के भागों में कर्नाटक राज्य के उत्तर कन्नड़ और शिमोगा जनपदों में सिरसी, अंबिकानगर और डंडेलीविच के आसपास के क्षेत्रों में स्थूल पैमाने पर 1577 वर्ग किलो मीटर में भूस्खलन संवेदंशीलता मानचित्रण किया गया है। इस कार्य को मद कोड: M4LSSM/NC/SR/SU-KG/2019/27979 के तहत उच्च रिज़ॉल्यूशन के रिमोट सेंसिंग डेटाबासिंड फील्ड इनपुट का उपयोग करके भूस्खलन की संवेदनशीलता मानचित्र को उत्पन्न किया।

पश्चिमी घाट में अधिकांश भूस्खलन ढलान की विफलताओं के कारण हैं। इस अध्ययन में उपयोग किए गए विषयगत मानचित्र भू-आकृति विज्ञान, लैंडयूज़ / लैंडकवर, ढलान बनाने वाली सामग्री, रेगोलिथ की मोटाई और ढलान के आकार के नक्शे जो कि गूगल अर्थ, मल्टी टेम्पोरल सैटेलाइट इमैरीज और कार्टोसैट डेटा का उपयोग करके तैयार किए गए हैं।

अध्ययन क्षेत्र पश्चिमी घाटों का एक हिस्सा है जो एक अविरल इलाके द्वारा चिह्नित है। डंडेली और अंबिकानगर के पास के क्षेत्र का उत्तरी भाग घने जंगल के कवर के साथ एक पहाड़ी इलाके में सम्मिलित है। इलाका असंख्य कम टीले और मध्यम विच्छेदित चोटियों से युक्त खुरदुरा है। घाटियाँ छोटे-छोटे अलग-थलग पतले पाटों से युक्त संकरी हैं। सिरसी के पास के क्षेत्र का दक्षिणी भाग लगभग कुछ अलग-थलग पहाड़ियों के साथ समतल है, जो पठारी क्षेत्र बनाता है। इस क्षेत्र में व्यापक रूप से खेती की जाती है, जो खेती किए गए भागों के आसपास की बस्तियों के साथ होती है। क्षेत्र में जल निकासी का पैटर्न मुख्य रूप से डेंड्रिटिक से सब डेंड्रिटिक है। रिज ढलानों में, ट्रेलिस और उप-समानांतर जल निकासी पैटर्न देखे जाते हैं। लगातार बारिश से उष्णकटिबंधीय जलवायु क्षेत्र में तीव्र अपक्षय और मिट्टी के निर्माण में सहायक साबित हुआ। चूंकि ढलान कम हैं इसलिये इन-सीटू मिट्टी में रसीली वनस्पति होती हैं। परिवहन मिट्टी मुख्य रूप से नदी चैनलों के किनारे तक ही सीमित है।

इस क्षेत्र में मुख्य रूप से सरगुर समूह, प्रायद्वीपीय नाइसिक कोम्प्लेक्स और धारवाड सुपर ग्रुप में आर्कियन युग की लिथो-इकाइयां उजागर होती हैं। इसके अलावा पैलिओप्रोटेरोज़ोइक आयु के यंगर इनट्रोसिव और सिनोज़ोइक आयु के लेटराइट भी उजागर होते हैं। धारवाड़ सुपरग्रुप चट्टानों से संबंधित शिमोगा बेल्ट, प्रायद्वीपीय नाइसिक कोम्प्लेक्स के बेसमेंट ग्रेनाइट नाइस के ऊपर है।

फील्डवर्क के दौरान क्षेत्र में 122 भूस्खलन पायी गयीं। जुलाई से अक्टूबर, 2019 के महीनों के दौरान दक्षिण-पश्चिम मानसून की लगातार बारिश से सभी भूस्खलन गिरना प्रारम्भ हो गयी थीं। भूस्खलन ज्यादातर कट स्लोप के साथ परिवहन कॉरिडोर या कृषि के कारण से थे। अधिकांश स्लाइड पृथ्वी और मलबे की स्लाइड्स हैं, एक बहुत उथले स्लिप प्लेन के साथ और उथली अनुवादकीय विफलता के कारण भी हुए हैं। देखे गए रॉक स्लाइड मुख्य रूप से अत्यधिक ज्वाइंटेड मेटा-आर्जिलाइट मे पाये गये जहाँ पर तीन ज्वाइंट सेट प्रमुख थे।

स्लाइड के लिए दो प्रमुख कारक थे जो कि ढलान के आधार के साथ धारा प्रवाह से टो कटिंग और दूसरा सड़क, बस्तियों और खेती के लिए अवैज्ञानिक कट ढलान है। स्ट्रीम शिफ्टिंग भी उस क्षेत्र में व्याप्त है, जहाँ वर्षों से खेती को सुगम बनाने के लिए धाराएँ किनारों में स्थानांतरित की जाती हैं।

भूस्खलन की संवेदनशीलता मानचित्र को विभिन्न विषयगत मानचित्र का उपयोग करके उत्पन्न किया गया था जो क्षेत्रों को सापेक्ष संवेदनशीलता के आधार पर क्षेत्र में विभाजित करता है। क्षेत्र का केवल 2% अत्यधिक अतिसंवेदनशील वर्ग के अंतर्गत आता है, जो ज्यादातर परिवहन गलियारों और व्यापक कटौती ढलान से सटे क्षेत्रों तक सीमित है। लगभग 81% (1279 वर्ग किमी) क्षेत्र भूस्खलन की कम संवेदनशीलता क्षेत्र के अंतर्गत आता है। 17% क्षेत्र मध्यम संवेदनशीलता क्षेत्र के अंतर्गत आता है। जब भूस्खलन की संख्या के साथ तुलना की जाती है, तो अधिकांश भूस्खलन कम संवेदनशीलता क्षेत्र के भीतर देखे जाते हैं, यह दर्शाता है कि मानव हस्तक्षेप के कारण परिदृश्य में परिवर्तन ढलान विफलता का एक प्रमुख कारण है। भूस्खलन से प्रभावित क्षेत्र उच्च संवेदनशीलता वाले क्षेत्र के लिए उच्चतम है जो दर्शाता है कि उच्च अतिसंवेदनशील क्षेत्र, भले ही क्षेत्र में सीमित हो, फिर भी काफी कमजोर है।

Chapter 1
INTRODUCTION

1.1 Background Information

Landslides caused by the intervention of human activities are increasing around the world and India is one of the countries affected on a major scale by it. Land use/land cover changes, irrespective of the changes being natural or man-made has the capability to influence the susceptibility of landslides (Diaz et al, 2005). The increasing population of the country has led to spreading of settlements in areas that were earlier considered not suitable for settlements, such as hilly and mountainous terrains. Moreover, recurring landslides and slope instability act as a major hazard as they lead to blockage of communication corridors, damage to agricultural land, settlements and loss of human life (Ghoshal et al, 2008). Countries along the equatorial and temporal regions are more vulnerable (Michael and Samanta 2016). India has almost 0.42 sq.km of landslide prone area. The landslides are mostly restricted to three zones- the Himalayan Orogenic Belt, the Eastern and North Eastern part of the country and the Western Ghat region. The Himalayan belt comprises of tectonically unstable younger geological formation subjected to severe seismic activity. On the other hand, the Western Ghats, though part of a geologically stable craton, are subjected to slope failure incidences as they represent an uplifted part of a plateau region affected by neo tectonic activity (Kale and Shejwalkar, 2008). The high seismicity of the Himalayas causes massive and highly destructive landslides (Kumar and Sati, 2004).

The Western Ghats represent a prominent hill range parallel to the western coast of the country (Oldham, 1894), which is also a faulted escarpment of the Deccan Plateau (Radhakrishna, 2001).The easterly slope is gentle and grades into the plateau, whereas the western slope, as it is a faulted escarpment, is quite steep (Basak and Narasimhaprasad, 1989). The mountain range also influences the climate of peninsular India, by creating the proper environment for the orographic precipitation during southwest monsoon (Pascoe, 2001). Along the Western Ghats in Karnataka, the districts of Kodagu, Chikmagalur, Hassan, Shimoga, Dakshin Kannada and Uttar Kannada are susceptible to landslides. As the Western Ghats experience humid and tropical climate, along with heavy monsoons, the rocks in the area aresubjected to intense weathering (Sajinkumar et al, 2011) and the slopes formed by such weathered material are highly susceptible to failure (Terlien, 1998). The hill ranges have also experienced a tremendous growth in population in the last 80 years making it one of the most populated mountain chains in India (Kuriakose, 2008).

It is very important to map landslides as it helps to determine the extent of damage and prioritize the rescue operations. Landslide hazard zonation refers to the process of ranking different parts of an area according to the degrees of actual or potential hazard from landslides (Varnes, 1984). The Geological Survey of India (GSI) has been designated as the nodal agency responsible for landslide inventory, susceptibility mapping and hazard assessment. The work is in progress for generation of a seamless susceptibility map on 1:50000 scale for the areas susceptible to landslides. For the state of Karnataka landslide susceptibility mapping was proposed for entire 34,156 sq.km area and the project were initiated from FS 2015-16. Out of this total area, an area of 26,909 sq.km was covered by the end of FS: 2018-19. The remaining area was covered during the current field season. The project was taken up with the following objectives

(i) Preparation of landslide inventory database using high resolution remote sensing data, archival information and field inputs

(ii) Preparation of spatial database for geo-factors of landslides on 1:50,000 scale

(iii) Categorization of hill slope in terms of landslide susceptibility using multi-class index overlay method in GIS platform.

Landslide susceptibility mapping on scale 1: 50,000 covering an area of 1577 Sq. Km. was carried out in parts of toposheet number 48I/12, I/16, 48J/13 and J/14 falling in Uttar Kannada and Shivamogga Districts, Karnataka under the Annual Programme of Geological Survey of India, Southern Region, vide FSP Code No: M4LSSM/NC/SR/SU-KG/2019/27979 for field season 2019-20.

1.2 Location and Accessibility

The area lies between latitude 14° 30'00" and 15° 15'00"N and longitudes 74° 30'00" and 75° 00'00"E and falls in parts of Uttara Kannada, Dharwar and Shivamogga districts, Karnataka in parts of Survey of India toposheets 48I/12, 48I/16, 48J/13 and 48J/14. Almost 98% of the area falls in the Uttara Kannada District, while a small portion in the south eastern part is part of the Shivamogga District. Sirsi, Dandeli, Ambikanagar are few of the important towns in the area. Sirsi is about 410km NW of Bangalore. A part of the area in the north falls under the Dandeli Wild Life Sanctuary and Anshi National Park.

Well metalled road connect most of the villages and towns in the area. Interior places are connected by network of fairly good motorable roads and foot/cart tracks. NH 766E and SH 93 are the major highways passing through the area. NH 766E (secondary route of NH 66) connects

Kumta to Haveri through Sirsi, Ekambai. State Highway 93 (SH 93) connects Khanapura to Talguppa through Haliyal,

Talguppa and Kumta are the nearest railway stations, while Haveri is the nearest major railway station for Sirsi. The major railhead is Hubli, which is the Zonal Headquarters of South Western Railways. Alnavar and Londa are the nearest railway stations, while Dharwad is the major railway station for the area near Dandeli. Yellapur and Sirsi.Hubli is the nearest airport for the study area.

1.3 Climate

The area has a humid and tropical climate and receives most of the rainfall from the South West monsoons. There is significant rainfall in most months of the year. In the areas around Sirsi, the climate is tropical, moderated by proximity to the sea. The short dry season has little effect on the overall climate. The climate of Sirsi is moderate and pleasant throughout the year with high humidity and with winter temperatures dropping below 15 °C (59°F). The highest temperature recorded here was 40.2 °C (104.4°F), and the lowest was 2.4 °C (36.3°F). Dandeli has an average elevation of 473 metres (1,552 ft) and receives heavy rainfall during August to November. The thick forest cover and moderate elevation give the area a tropical highland climate, averaging about 27 °C (81°F) in summer and 18 °C (64°F) in winter.

1.4 Flora and Fauna

The heavy rainfall predominant in the area has aided in the development of thick tropical forests. There are tropical evergreen forests to thick deciduous forests. Eucalyptus, teak and bamboo are developed by the Forest department. Dandeli Wildlife Sanctuary is famous for the elusive Black Panther among other animals like gaur, tiger and leopards, elephants, deer and antelope. It is the second largest wildlife sanctuary in Karnataka and was designated as a tiger reserve in 2007. The jungle is also home to several varieties of reptiles and almost 300 varieties of birds

1.5 Physiography

The area forms a part of the Western Ghats and is marked by an undulating terrain. The northern part of the area, near Dandeli and Ambikanagara comprises of a hilly terrain with thick

forests. The terrain is rugged with innumerable low mounds and moderately dissected ridges. The ridges trend in the NW-SE direction in general. The valleys are narrow with small isolated cultivated patches. The southern part of the area near Sirsi is a more or less flat country, with few isolated hills, forming a plateau region. The highest elevation is 726 m above msl. and the lowest elevation is 220 m above MSL noticed on the Bedti River bed.

The drainage pattern in the area is mainly dendritic to sub dendritic. Along the ridge slopes trellis and sub parallel drainage pattern are observed. Kali Nadi is the major river flowing through the northern part of the area and acts as the lifeline for almost 4 lakh people. The river flows entirely through the Uttara Kannada District only. There are numerous dams built on the dam for power generation. The River Varada, is a tributary to the Tungabadra and flows through the south eastern part of the area. The Bedti or Gangavalli River is another major river draining the area. It originates in the Western Ghats and flows west to south west before joining in Arabian Sea. Shalmala and Sonda are its tributaries. The river flows through gorges at places and are numerous waterfalls along the course of the river.

1.6 Geology of the area

The area exposes lithounits of Archean- mainly Sargur Group, Peninsular Gneissic Complex and Dharwar Supergroup, Palaeoproterozoic Younger Intrusives and Laterites of Cenozoic age. The Dharwar Supergroup of rocks pertaining to Shimoga belt is exposed overlying the basement granite gneiss of Peninsular Gneissic Complex

The regional litho stratigraphy is given below

Table 1.1: Regional Stratigraphy of the area after Iyengar, (1965, 1968),

Supergroup	**Group**	**Formation**	**Litho unit**
			Laterite
	Younger Intrusives	Acid Intrusives	Quartz Vein
		Basic Intrusives	Dolerite, Other basic intrusives
Dharwar Supergroup	Chitradurga Group	Rannibennur Formation	Banded Iron Formation
			Argillite
		Joldhal Formation	Meta Basalt
			Banded Iron Formation
			Argillite
			Manganiferous phyllite
			Limestone
Peninsular Gneissic Complex	Peninsular Gneisses I		Granite Gneiss

Sargur Supergroup			Ultramafite

Meta-ultramafite is the only lithounit representing the Sargur Group, occurring as a lensoidal body within the PGC. This unit is fine grained, greenish grey and consists of talc-actinolite, tremolite and chlorite.

The Peninsular Gneissic Complex forms the basement and is represented by granitic gneiss and is exposed in the north western part of the area. It occurs as lensoidal bodies, trending NNW-SSE surrounded by the schistose rocks of the Chitradurga Group. It is coarse granined, mesocratic composed of quartz, plagioclase and mafic minerals. Along the boundary of the gneissic unit, in contact with the schistose rocks, well developed foliation is observed.

The Dharwar Supergroup is represented by rocks of the Chitradurga Group comprising Joldhal and Ranibennur Formations of the Shimoga Belt.

The Joldhal Formation comprises of limestone, manganese phyllite,argillite, banded magnetite quartzite and metabasalt and they represent shelf facies sediments.

Limestone occurs as linear bands in contact with argillite and PGC. It is fine grained, dark coloured and is composed of mainly calcite. Manganiferouschert/phyllite occurs as pink coloured, fine grained linear bodies, with well-developed fabric occurring 4 km west of Ambikanagar and north and south of Shirdi mines camp. The unit is extensively lateritised with the development of residual manganese and numerous manganese mines and old workings are recorded in this unit. Argillite occurs as narrow bands bordering the PGC. It is grey coloured, fine grained and composed of quartz, feldspar and chlorite. BMQ occurs as linear bands associated with manganiferous phyllite and represent shelf facies sediments. They are fine grained with distinct rhythmic banding of quartz and magnetite. A small patch of metabasalt is exposed SW of Ulvi village. The litho unit is dark green, fine grained, amygdular and composed of chlorite, actinolite, plagioclase and epidote with minor amounts of quartz.

The Joldhal Formation is overlain by a thick pile of greywacke-argillite sequence of Ranebennur Formation. The greywacke- argillite sequence is inter banded with Banded Iron Formations varying in width from 5-20 m and having a strike length of 1-25m.

Greywacke-argillite of Ranibennur Formation is massive to schistose, fine to coarse grained, laminated at places, compact, banded, slightly metamorphosed, grey to dark grey in

colour, consists of angular to sub-angular grains of quartz, chlorite, sericite. Iron ore, actinolite and epidote occur as accessories and specks of pyrite are observed at places.

BIF is represented by Banded Magnetite Quartzite (BMQ) and Banded Ferruginous Quartzite (BFQ). The BIF bands are dark grey in colour, well banded, hard, compact, and composed of alternate bands of chert and iron. The iron content is very poor. Two thin bands of banded magnetite quartzites are seen exposed in the area. In the western part BMQ band extends from hill Δ 594 m in the north up to the west of Melagaon along Bedti River. It is faulted and shifted towards east and is picked up on the hill east of Suremane and extends up to Katgi. The second band BMQ band occurs in the eastern part of the area. It is exposed at east of Gunjavati in the north and extends up to northeast of Kurli. This BMQ band also faulted along the Kaulgi stream section and the band is shifted towards east for about 3 m.

Narrow bands of banded ferruginous quartzite (BFQ) are seen exposed within greywacke-argillite one such BFQ band is exposed in the northwestern part of the area. The band is about 9 km strike length runs from 2.5 km south of Bhairumbe and extends up to Sonda and beyond. BFQ band exposed in the southern part of the area at 2.5 km southeast of Kanasur. This band is about 3.5 km strike length runs in NNE-SSW direction.

Dolerite dykes represent the basic intrusives in the area. The trend of dykes varies from N-S, NW-SE, NNE-SSW and NNW-SSE direction traversing the greywacke-argillite. Few of the dykes show E-W trend as well. They occur as boulder outcrops and are intensely joined. Dolerite is dark green, fine to medium grained and consist mainly pyroxene and plagioclase.

Quartz veins of Paleoproterozoic age represent the younger Acid Intrusives in the area. They traverse the greywacke-argillite, trending NE-SW. it occurs as a massive unit, milky white in colour and devoid of any form of mineralization. Quartz veins also occur north and southeast of Gunjavati. Trending in the NW-SE direction

Laterites of Cenozic age are observed as patches in the south eastern part near Sirsi and Bisalkoppa villages and North West of Manchikeri village. The laterites are ferruginous in composition. The soil cover is rather thick ranging from 3-7 m. It is generally grey to black coloured, clay to sandy soil.

Primary structures such as banding are well developed in the BIF, but poorly developed in the greywacke-argillite. Cross bedding is observed in the argillites (grit) in few exposures along the Kaulgi Halla. Foliation is well developed in the argillaceous rocks. At most places, the bedding

and foliation are parallel to each other, trending N-S to N10E-S10W with moderate to high (40-70) easterly dips. At some places, S0 and S1 are parallel with NW-SE trends and moderate dips (30-40). Regional antiformal structure plunging SE is exposed in the north central part of the area, where the Dharwar Supergroup of rocks enveloped by the basement gneiss - the latter at the core. The schistosity-bedding relationship reveals that the beds are younger towards east. .Two BMQ bands are displaced by a ENE-WSW trending faults. The fault plane extends from Melagaon to Rayanhalli.

1.7 Methodology

The theme of the project is to prepare a landslide susceptibility map on 1: 50,000 scale. A landslide dependent model following a raster based GIS modeling approach is followed, with the model formed by integration of all selected and weighted thematic maps. In case of areas, where prior information regarding the landslide is missing or scarce, any one of the following options may be adopted as per priority or terrain conditions after due discussion with local experts. (Fig 1)

a. On the basis of a pilot study in an adjacent smaller area or any road corridor (most preferably within the area of study) where well distributed landslide data is available, individual ratings for geo-factors and the weights of the geo-factors will be determined using spatial association techniques. The same ratings and weights willthen be applied for the entire study area for integration of the model using the same multiclass index overlay method. In case reports of similar research work is available for the adjacent area, having similar terrain, the same ratings and weights may be applied in the current work after due discussion with local experts.

b. Individual ratings for the geo-factor classes and weights of geo-factors will be determined using Analytical Hierarchy Process (AHP) after preparing the pair wise qualitative comparison matrix of all factors (Saaty, 1977) after due discussion with local experts and workers.

The methodology to be adopted can be broadly classified as follows-

1.7.1 Pre-field studies:

As part of pre-field studies, various thematic maps are generated using different sources. Mainly, nine thematic maps are used- Slope morphometry maps (slope aspect, slope curvature and slope angle) and drainage maps are derived from CARTO DEM- 30m (Digital Elevation Model prepared from data of the satellite CARTOSAT) as raster outputs.

The following maps are used for AHP based data modeling and analysis

1. Geomorphology and Landuse-Landcover (LULC) maps are prepared using google earth satellite imageries (Multi temporal images have been used for digitization of Geomorphology layer and image generated in the period between November 2011 to March 2012 was used for digitization of LULC layer) are prepared as vector outputs.
2. Slope Forming Material (SFM) and Regolith Thickness (RT) maps are generated from using proxies from Lithology (from the geological map of the area), LULC and Geomorphology maps in Arc GIS platform.
3. Drainage and Slope Morphometry maps are preperated from CARTOSAT-DEM data
4. The landslide inventory map is prepared by consulting existing landslide reports available in GSI and published journals/ articles and from google earth satellite imageries.

The spatial database is finalized in GIS, which aids in easy updating and modifications of the geo-factors during validation.

1.7.2. Field Based Studies

The main objective of the field studies is to validate the pre-field data

1. Validation of the pre-field maps, viz. Geomorphology, LULC, Slope Forming Material (SFM) and regolith thickness (R.T) map
2. Validation of existing landslide database and augmentation by identifying new slope failure incidences and recording the field observations as per the 42 geo parametric sheet for individual slides.

1.7.3. Post field studies:

The post field activities comprises-

1. Updating of pre-field maps: the pre-field maps are validated in field and the modifications incorporated wherever necessary. The corrections are done on the Arc GIS platform and all the thematic maps finalized

B. Landslide Susceptibility Modeling: Raster based GIS modeling is carried out. Analytical Hierarchy process (AHP) is used for landslide analysis and in the preparation of landslide Susceptibility Map, rather than the landslide dependent Model (involving statistical analysis of

landslide incidences) due to lesser number of landslides. The AHP is multi criteria decision making process of measurement through pair-wise comparison and it relies on the judgment of the experts to drive priority scale (Saaty 2008). The entire process of landslide susceptibility modeling is given below

1. Criteria for assigning ranks to Geo-factor Classes and Maps: the rankings for each of the geo-factor classes was done after consultation with experts working in the domain of landslides in different parts of the country, taking into consideration their knowledge, field experience and observations. The average rank was assigned for every geo-factor map, based on its probability in inducing a slope failure. The consensus on ranking was developed to bring uniformity of approach in identifying similar landslide susceptible zones in Western India, Maharashtra in particular. The 9 point ranking scale (ranging from 0 to 9, with 9 being the highest ranking) was finalized and each class/ geo factor was ranked accordingly. The classes having higher chances of inducing failure were assigned higher ranking.

2. AHP Modeling: for AHP modeling, pair wise comparison matrix of geo factor classes was executed after calculation of Eigen values, fraction rate values and Landslide Occurrence Favorability Score (LOFS) ratings. Once the LOFS ratings for individual geo factor classes for a particular geo factor map is calculated, integer weights of individual maps are also calculated. The integer weights are normalized by minimum weights after that. A raw susceptibility score map was generated using integer weights and LOFS values. The map thus generated, was reclassified based on the logic of providing mutual comparison expert driven ranking of High, Moderate and Low Categories/ classes. For the high-moderate and moderate-low classes, a cut off was set at 50% and 30% respectively.

1.8 Present Work

The present work comprises preparation of various thematic maps on 1:50000 scale using Survey of India Toposheets, Carto DEM data and Google Earth imageries at headquarters. The landslide inventory is prepared prior to initiation of field work from previous literature and Google earth imageries and validated in field. The pre-field maps are also validated in field and updated in Arc-GIS platform. The final landslide susceptibility map of the study area is prepared using Knowledge driven indirect method (Analytical Hierarchy Process) and then classified into low, moderate and high susceptibility zones.

The nature and target of work envisaged for FS: 2019-20 and the achievements are given below

Table 1.2: Nature and quantum of work and time schedule for the project

Nature of Work	Target FS 2019-20 (Sq.km)	Achievement FS 2019-20 (Sq.km)
1. Pre-field map preparation		
i)Thematic maps (in GIS on scale 1:50000)	1577	1577
a. Slope Forming Material map	1577	1577
b. Geomorphology & Lineament map	1577	1577
c. Slope Morphometry (slope, aspect & curvature) map	1577	1577
d. Land use - Land cover map	1577	1577
e. Drainage map	1577	1577
f. Regolith thickness map	1577	1577
ii) Landslide inventory map	1577	1577
2. Field Studies		
i) Field checking of all thematic maps	1577	1577
ii)Field checking and collection of landslide inventory attributes (42 point geo -parametric sheet)	1577	1577
3. Post field studies and modelling		
i)Updation of thematic and landslide inventory maps	1577	1577
ii)Landslide susceptibility modelling and finalization of landslide susceptibility map in GIS	1577	1577
4. Collection of Rainfall data	1577 (Rainfall data collected from Uttara Kannada and Shimoga Districts)	

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Chapter 2

Previous work on Landslide Studies

Landslides/ Slope instabilities can occur in natural conditions or may be induced along artificially modified slopes. Under natural slope conditions, landslides mainly occur when there are favourable geo-environmental conditions, triggered by either rainfall or earthquakes (Van Westen et al., 2008). In the case of modified slopes- where the slopes are modified for settlements, cultivation or construction, their failure depends on a number of factors, making it even more challenging to predict when they may occur. Landslide studies are important as slope failures tend to modify the environment we live in, including the topography of the area, affect human life, property as well as the economy. The evaluation of landslides is difficult as they are dependent on a number of factors.

The state of Karnataka occupies an area of 191176 sq.km, out of which 34511 sq.km forms the Western Ghats. The Western Ghats extend from Uttara Kannada District in the north to Kodagu district in the south and comprises of chain of mountains occurring as rolling hills.

Highways and Railway lines act as the lifelines for the growth of economy of any country. In Karnataka, there are 14 National Highways and 115 State highways with a total length of 28311 km, along with railway lines aiding to the connectivity of the state. The Konkan Railway line and many National Highway pass through the Western Ghats. Initially, landslide studies were restricted to the National Highway/ State Highway (NH/SH) corridors in Karnataka and Goa, where landslides were a common phenomenon during the monsoons. These slides occurred along slopes that were modified unscientifically for road and settlements and thereafter left untreated. Rainfall acted as the triggering factor for most of these slides. As Karnataka and Goa receives heavy rainfall during the months of June-September, this period sees a number of landslides in various parts of the state, especially along the Ghat sections. These landslides block the road, at times for days altogether.

Landslide inventory studies were carried out by Maruthi and Chandran (2012) along NH and SH 19197Ghat roads in Uttara Kannada and Chickmagalur districts. The studies were carried out along SH-93 for the stretch from Sirsi to Siddapur. 11 landslides (only seven slides in the present study area) were recorded along the 35km road stretch of the ghat section. It is noticed that most of the landslides were along cut slopes with height >10m. The major causes of landslides in the area are toe cutting of slopes for road cutting and slope modification for human settlements.

Moreover, these areas receive heavy rainfall; the rocks in the area are also highly weathered. During the monsoons, the intense rainfall causes the slope to fail thereby acting as a triggering agent. The majority of slides were found to be debris slides and slumps caused mainly due to tampering of the natural slope for making road.

Table 2.1: Inventory of landslides along stretch from Sirsi to Siddapur

Slide No	**Location**	**Toposheet no**	**Latitude**			**Longitude**			**Elevation (M)**	**Taluk**
KA-469	3 KM from Sirsi on SH-93 towards Siddapur	48J/14	14	33	28.9	74	49	16	550	Sirsi
KA-470	500 m from slide no KA-469 on SH-93 towards Siddapur	48J/14	14	32	51.1	74	49	23.1	559	Sirsi
KA-471	1 km from slide no KA-470 on SH-93 towards Siddapur	48J/14	14	32	34.2	74	49	43.6	567	Sirsi
KA-472	Near Ajjabale on SH-93	48J/14	14	31	51.6	74	49	55.3	550	Sirsi
KA-473	Near Kanasur on SH-93	48J/14	14	30	32.1	74	50	55	517	Sirsi
KA-474	1 km from slide no KA-473on SH-93 towards Siddapur	48J/14	14	30	19	74	51	55	536	Sirsi
KA-475	Near Dungamal	48J/14	14	30	5.4	74	51	56	525	Sirsi

The Centre for Ecological Studies, Indian Institute of Science, Bangalore carried out landslide susceptibility mapping in Uttara Kannada as part of their Sahayadri Conservation Series -ENVIS (Environmental Information System) Technical Report (2012). According to them the change in land use pattern has contributed in large amounts to the increase in landslides in the area.

The conversion of land under forests to agricultural land has drastically led to increase in incidences of slope failure in the area. They carried out landslide hazard modeling in the Sharavati and Agnashini river basin.

Kapil Singh and Sovesh Dulal Muduli (2019) carried out landslide susceptibility in the area north on the present study area (toposheets 48I/8, I/10 and I/11) during F. S. 2018-19. 31 landslides were identified during the course of work and it is noticed that most of the slides occurred on sloped modified for road cuttings. The triggering factor for slides in the study area is mainly rainfall which has contributed to increase in the pore pressure of the weathered rock mass resulting in reduction of shear strength and subsequent failure.

Zameer Ahmad Shah and Kapil Singh (2016) carried out landslide susceptibility mapping in parts of toposheet 48J/5 and J/9, lying to the west of the present area. 17 slides were marked during the course of work. Most of the slides were of shallow translational nature and are confined to road cuttings. Only 5% of the total area fell into the high susceptibility zone.

Chapter 3

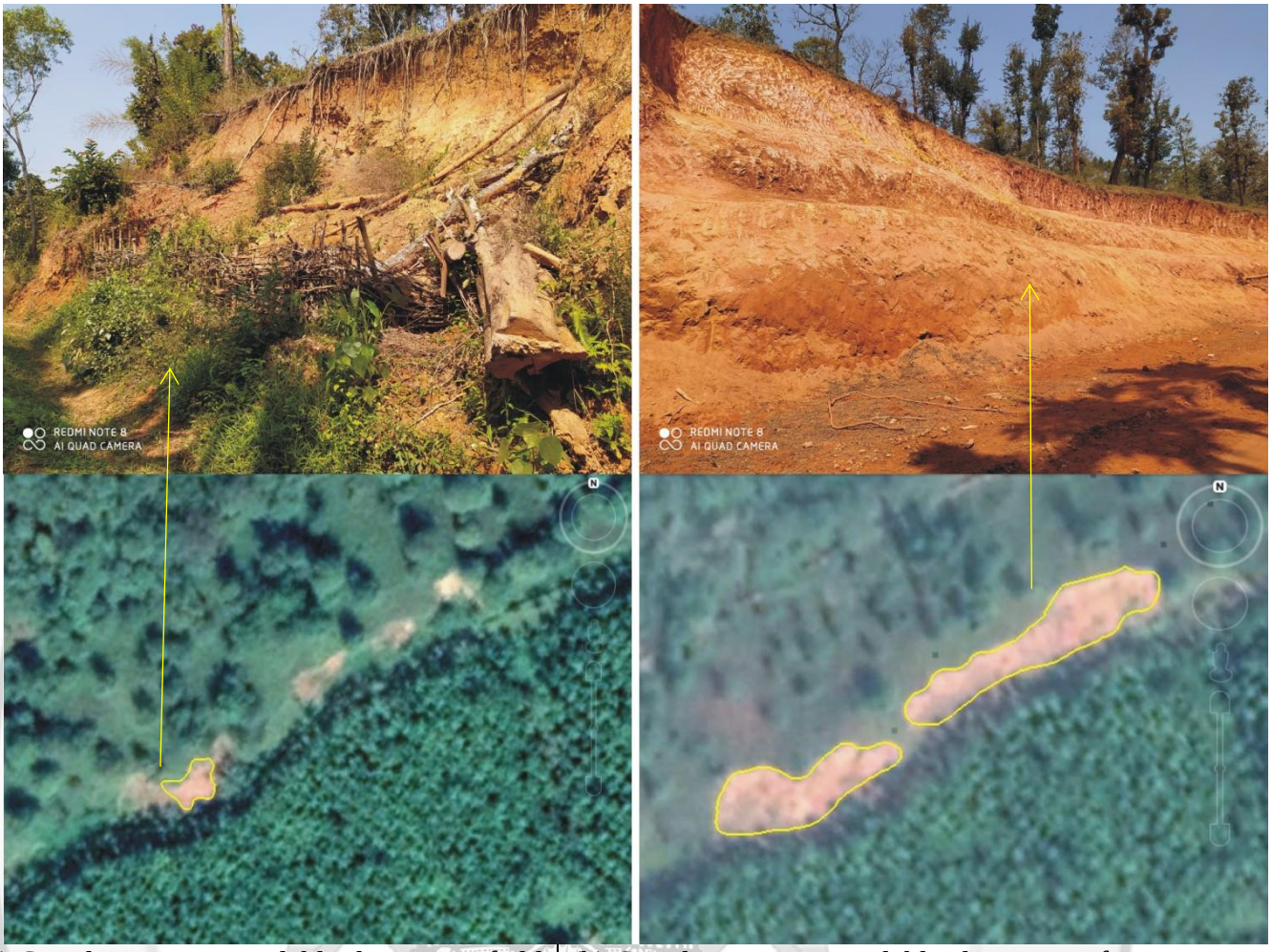
LANDSLIDE INVENTORY

3.1 Remote Sensing Data Inputs

The Geological Survey of India had carried out landslide inventory studies in various parts of Uttar Kannada district during 2010-2012. Maruthi and Chandran (2012) carried out landslide inventory studies in different parts of Uttar Kannada and Chikmangalur districts including 48J/14 also, which forms part of the present study area. However, landslide inventory studies have not been carried out in the other toposheets, i.e. 48J/13, 48I/12 & 48I/16.

The preparation of landslide inventory for given study area of 1577 sq.km was one of the objectives of this work. In pre-field studies Google Earth satellite imageries were explored and utilized as remote sensing source for demarcation of visible landslides. Landslide locations earlier recorded by previous workers in area, were also explored and added to pre-field based landslide inventory database. It is worthy to utilize freely available Google Earth Imageries for landslide boundary demarcation but there were few constraints of having vegetation cover and date of imagery capture.

In the Western Ghats, the thick vegetative cover tends to act as a canopy for landslides, making it difficult to demarcate them. This factor minimizes the level of identifying and demarcating the landslide boundaries on Google Earth Imageries. Date of imagery capture plays a very important role during the whole investigation period. Most of landslides in the area were marked during the field investigations. These landslides are visible in imageries available after pre-field studies and are corresponding with the field recorded landslide locations. Representative location is illustrated in Fig 3.1. Therefore, field check and validation are very important when remote sensing data is being used, even if the data is of high resolution. These constraints of pre-field studies were carefully handled with a cautious approach and rectified in field studies.



(a).Google Imagery available during pre-field studies April-September, 2019.

(b).Google Imagery available during or after field investigations October, 2019-March, 2020.

Fig 3.1: Google imageries available in different time periods and the changes in landslide influenced area boundaries (in yellow lines) on same location in Chauti, Sirsi, Uttar Kannada.

3.2 Field Check and Landslide Inventory Map

118 no. of landslides have been demarcated during the investigation and added to landslide inventory (see table-3.1).Along with these landslides, four landslides have been reported outside the study area, which have also been added to the inventory database. Very few landslides could be marked initially from remote sensing sources during pre-field studies due to the presence of dense vegetation cover over the area. Landslides detected from remote sensing sources have been checked during field studies and are found existing on the ground. Few such landslides are represented in Plate 2. All accessible landslides have studied thoroughly during field studies and

their relevant attributes/information has been recorded for future reference **(see annexure-I).** During the field investigation, the authors have given thrust upon landslide classification, generic causative factors for occurrence of landslides, identification of different thematic features accelerating mass/land movement in the area. The workers have suggested general remedial measures after deliberation on all attributes of landslides occurred in the area. The reported landslides in the study area have triggered by rainfall.

3.3 Landslide Types and Their Causative Factors

The representative field photographs of different types of landslides reported in study area are shown in figure-3.3.Most of these landslides comprise in-situ earth material formed by weathering processes and few landslides comprise debris material eroded and deposited by natural agencies. It is observed in field that both in-situ earth/soil as well as debris material has slided down a visible and well distinguishable rupture surface, with a translational movement. Most of the landslides are of shallow depth (<5m) and run for short distances (1-2m). These landslides have occurred in an under-saturated condition where unit mass increases by addition of water to the surface material (clayey silt) having moderate porosity and permeability characteristics. When this condition arises, the slope cannot continue to be stable, where there is removal of toe support, high slope angle and high gravitational pull. Very few landslides occurred in the area have seen in which shallow depth surface material has flown down under saturated condition to long run out distances.

The workers have observed that although very prominent joint sets have developed in rocks in the area and have produced joint interference patterns, very few places have witnessed rock failures, that too on a minor scale (see figure-3.3p&q). Despite the joint interference mechanism in rocks, the rock failures are less because weathering is deep in the area. The deep weathered cover does not allow the underlying rocks with joint interference patterns to slide until these rocks exposed to surface at high slope angle. During the field investigation it has been found that most landslides have occurred on banks of modified streams, on modified slopes or along road sides and few landslides have occurred on natural slopes with or without drainage and modification. Many of the landslides have also been induced by anthropogenic causes, like cut slopes for road and settlements. People have cut down stream bank slopes extensively for cultivation and settlement purpose. They have modified the natural stream courses and shifted it to periphery boundaries from decades. This human induced shift of natural stream course is accelerating now

by high water action during rainfall period. The high water action in these streams tends to erode the banks, mostly along the outer meander very rapidly. This erosion, causing removal of the toe portion of the slope has led to frequent occurrence of landslides in the area. It cannot be ignored that due to shifting of streams over long periods, wide geomorphological valleys are left behind. These valleys could also be indicative of geological disturbances in the area due to neotectonic activity. The topic needs further detailed study before any conclusions can be made.

Several landslides in study area have occurred quite due to natural causes. Among which localized faults and joint patterns are playing important role. Several landslides have occurred along roads where slope angle is high and have left without proper reinforcement/support for stabilization. Few landslides along roads have occurred where streams/rivers are passing through via bridges, culverts etc. and eroding the toe material on both abutments. As such there are no supporting structures given to abutments of bridges and culverts in the area for stabilizations although which is very necessary. The people residing in the area also modify the drainage and natural slopes without giving any proper reinforcement/support for stabilization.



(a). *Earth slide occurred near Jananalli village(L 190) by removal of toe support by anthropogenic activity.*



(b). *Earth slide occurred on upslope side of road near Tuduguni village(L 189) by road cutting activity without giving reinforcement.*



(c).*Collapse of stream bank slope occurred near Kummanmane village (L 206) by removal of toe support by anthropogenic activity as well as stream water action.*



(d).*Earth mass movement occurred on upslope side of road near Kanchimane (L 219) by road cutting activity without giving reinforcement.*



(e).*Collapse of stream bank slope occurred near Atbail village (L 263) by removal of toe support by anthropogenic activity as well as stream water action.*



(f).*Collapse of stream bank slope occurred north of Kannur village (L 275) by removal of toe support by anthropogenic activity as well as stream water action.*



(g).*Debris slide occurred near Mankuli village (L 284) by removal of toe support by anthropogenic activity.*



(h).*Surface crack developed in debris material of a foot slope near Mankuli village (L284).*



(i).*Collapse of river bank occurred in L314 by deep under bank erosion by water action.*



(j).*Collapse of river bank occurred north east of Else village (L323) by deep under bank erosion by water action.*



(k).*Shallow debris flow occurred on upslope side of road in L367by over-saturation of slope material with >45° angle.*



(l).*Shallow debris slide occurred on upslope side of road in L401by increase in unit mass of slope material in under-saturated condition.*





(m).*Initiation of movement of in-situ slope material on extensive cut slope given during road constructional work and have left without reinforcement in L402.*



(n). *Earth slide occurred in L110516 due to removal of toe support by anthropogenic activityand stream bank erosion by water action.*



(o).*Shallow earth slide occurred on high angle downslope side of road in L110516due to removal of toe support by anthropogenic activity.*



(p). *Joint development and joint interference pattern in Ganeshpal village, Sirsi and resulting wedge failures but at minor scale because of low slope angle.*



(q).*Joint development and joint interference pattern in Hulekal village, Sirsi and resulting wedge failures but at minor scale because of low slope angle.*

Figure-3.3: Field photographs from (a)-(q) depicting different types of landslides occurred in study area

3.4 Landscape Type and Field Evidences

The landscape term is a regionally defined geophysical landmass comprising a unique set of geophysical elements of landforms broadly including mountains, hills, valleys, rivers, lakes, sea, coasts, plains, escarpments, cliff, ridges etc. The landform geophysical elements are the basis for classifying a landscape. The landscapes are dynamical landmass features controlled broadly by

climatic, lithological, tectonic activities and denudation processes. The landscape changes have been witnessed from their origin to recent by studies carried out with time.

The present study area lies in the Western Ghats of Indian Peninsula which has a more complex pattern of landscape development and evolution. There are denudation plains, dissected hills and valleys, rivers, escarpments, ridges, mounds, sea and coastal plains and few lakes which form the Western Ghats landscapes. However, the absence of mountains and associated geophysical landform elements differentiates the Western Ghats from other landscapes. Regional studies (Kale and Peshwa, 1988) suggest that there are external controls including climate, base level change, bedrock erosion which have attributed to landscape development and evolution in Western Ghats. However in present study the field evidences suggest that geological structure and erosional controls have attributed to landscape development and evolution in Western Ghats parts of Uttar Kannada. Different geomorphological and lithological evidences collected in present study area suggest that there would have been a period of local structural disturbance in the area in recent past which have brought new topographic and lithological features in place like development of fractured front with high slope gradient and dense drainage pattern from lowly dissected landform which was probably evolved since its inherent phase; development of isolated basins and subsequent deposition of quaternary sediments including gravel, sandy silt and clay layers within these isolated basins; appearance of moderate grade type of metamorphic rock (schist) on surface along fractured front whereas this rock type is not exposed anywhere in surrounding area; development of nick points along major rivers/streams; appearance of seasonal springs; exceptionally thick in-situ overburden cover on steep slopes. These field evidences (Fig 3.4) which have left behind preserved in present study area of Western Ghat during its landscape evolution, should be taken for further studies at regional level.

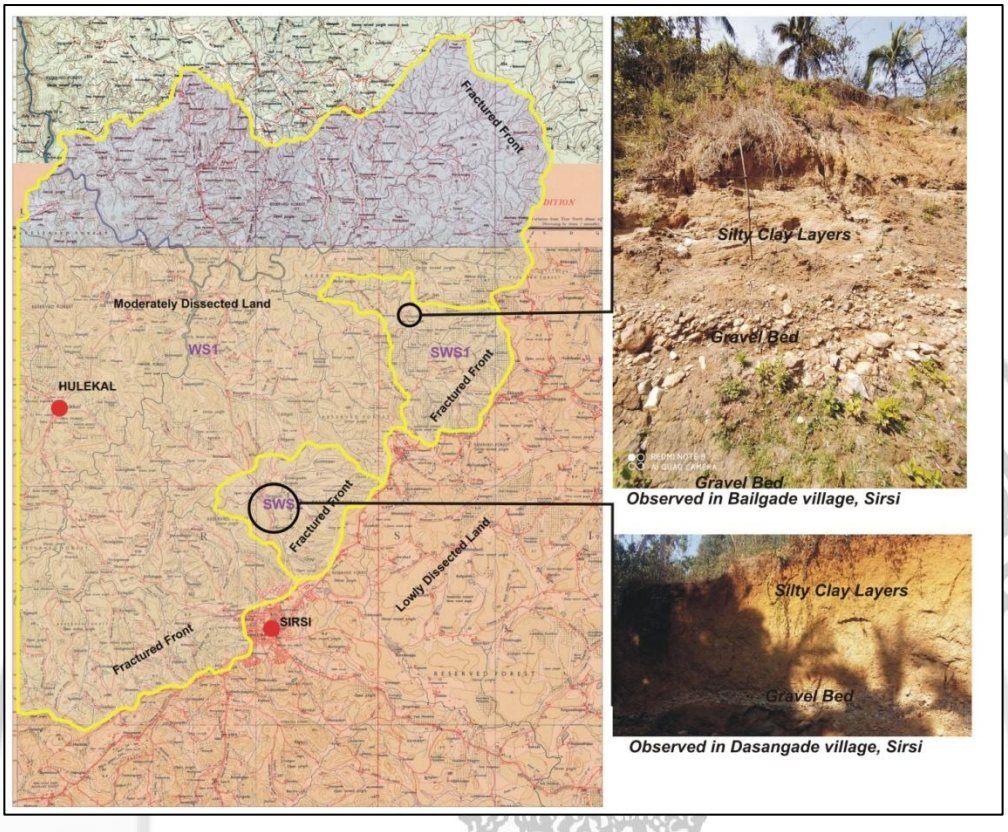


Fig-3.4: Shows how the fractured front has evolved from lowly dissected land with <15° slope angle in a recent past structural disturbance from which some lithological indicators have preserved as shown in photographs. WS; watershed, SWS; sub-watershed

Chapter 4

Landslide Susceptibility Analysis

Landslides occur when the shearing stress along the failure plane exceeds the shearing strength of rock/debris mass (Varnes 1978). Landslide occurrences in an area are controlled by factors that are specific to that particular site or terrain. The various geo-factors (lithology, drainage, geomorphology, land use, etc) are taken into consideration as a multivariate analysis is required to determine the relative probability for the occurrence of landslide in an area. A landslide susceptibility map gives an idea about how an area, under the effect of several factors may behave in the landslide perspective. Since the study area lacks natural and sufficient number of landslides AHP method of analysis is used. The analytical hierarchy process (AHP) is a semi-quantitative method in which decisions are taken using weights through pair wise relative comparisons without inconsistencies in the decision process (Saaty, 1980). These factors are assigned a hierarchic order and numerical values to subjective judgments based on the relative importance of each factor (Himan Shahabi & Mazlan Hashim, 2015).AHP operates at four levels viz. defining problem, determination of goals and alternatives, construction of pair wise comparison matrix, determining weights and obtaining overall priority

The advantages of using AHP as an expert based method in landslide susceptibility analysis (Long and DeSmedt, 2012) are : (i) all types of information related to landslides can be included in the discussion process; (ii) judgment is structured so that all information is taken into account; (iii) discussion rules are based on expert's knowledge and experience; (iv) when a consensus is reached, weights for each relevant factor are obtained automatically by eigenvector calculation of the comparison matrix; and (v) inconsistencies in the decision process were verified using consistency index values.

4.1 Selection of pre-preparatory factors

The pre-preparatory factors refer to those factors which make the slope susceptible to movement without actually initiating it and thereby tending to place the slope in a marginally stable state. The stability of a slope is directly related to the type of terrain, presence of discontinuity surfaces, morphology of the slopes (slope angle, aspect, curvature, land use and hydro geological conditions, etc.), whereas the triggering factor for landslides, is usually connected to internal and external conditions, such as intensive rainfall or earthquakes (Costanzo et al., 2012).

As per data model is concerned, some of the geofactor themes are categorical (e.g. geomorphology, aspect etc.) and others represent continuous data (e.g., slope, elevation etc.) These spatial geo-factor maps are prepared using various source data and employing different mapping techniques:

4.2 Geo-factor Themes

The geo-factor thematic maps used for landslide susceptibility analysis are

4.2.1 Slope Morphometry–Slope morphometry is defined by slope gradient, aspect and curvature. The data was derived from CARTO DEM having 30m resolution, downloaded from BHUVAN portal. Slope gradient and slope curvature for the study area was generated on ArcGIS platform using spatial analyst tool and the raster generated in resampled to 50m resolution.

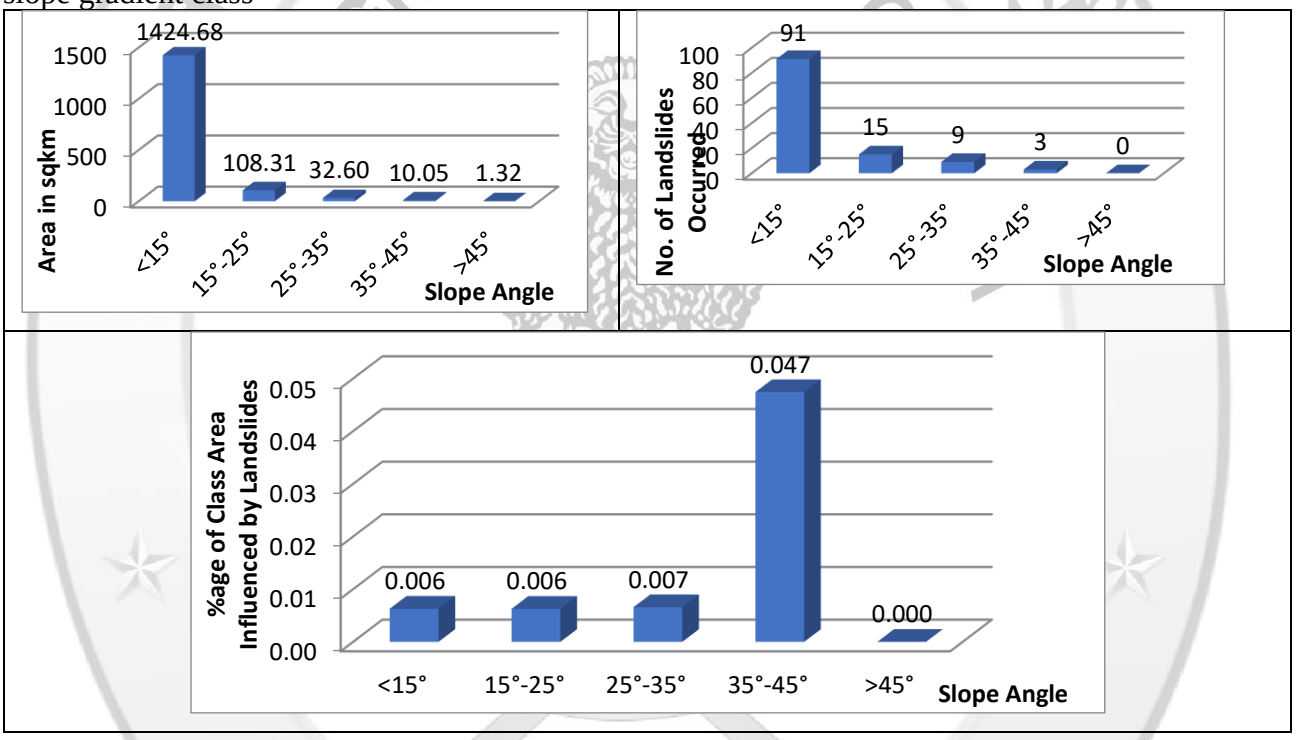
Slope gradient-The slope gradient or slope angle is a key parameter in determining landslide susceptibility. According to Katz et al (2014), the greater the slope angle, more material disintegrates for **a** given material strength, and consequently a larger landslide occurs. Chen et al (2015) however concluded from studies based on limit equilibrium simulations that the sliding mass volume decreases with the increasing slope angle for a given material strength, thereby concluding that for a given material, there exists different controls of the slope angle on the landslide size.

Slopes are categorized into 5 classes <15°, 15°-25°, 25°-35°, 35°- 45°, >45° and the map is given in Plate 4. It is observed that almost 77% (of the landslides observed in field, fall in the low slope category, i.e. <15°. 12% of the landslides are observed in the 15°-25° slope class, 7% and 2% in 25°-35° and 35°-45° gradients. No slopes are observed in the >45° degree class, against the usual notion that steeper the slope greater is the chances of slope failure. Almost 90% (~1425sq.km) of the area comes under the class <15%, indicating gentle slopes, which are used for cultivation and plantation. The class 35°-45° has the maximum influence of landslides (0.047%), indicating that areas with slope angle within the category are more vulnerable to failure. All the other classes show almost equal influence by landslides.

Table 4.1: Table showing area and distribution of landslides for Slope Classes

CLASS	Rank	Class Area (sqkm)	No. of Landslides Occurred	Landslide Area (sqkm)	%age of Class Area Influenced by Landslides	LOFS
<15	**2**	1424.68	91	0.089522	0.006283646	0.1631
15-25	**4**	108.30	15	0.006794	0.00627288	0.4597
25-35	**8**	32.6	9	0.002145	0.006579755	1.0000
35-45	**6**	10.04	3	0.004763	0.047416625	0.2817
>45	**2**	1.315	0	0	0	0.1631

Fig 4.1 Graph showing area occupied, number of landslides and influence by landslides for each slope gradient class



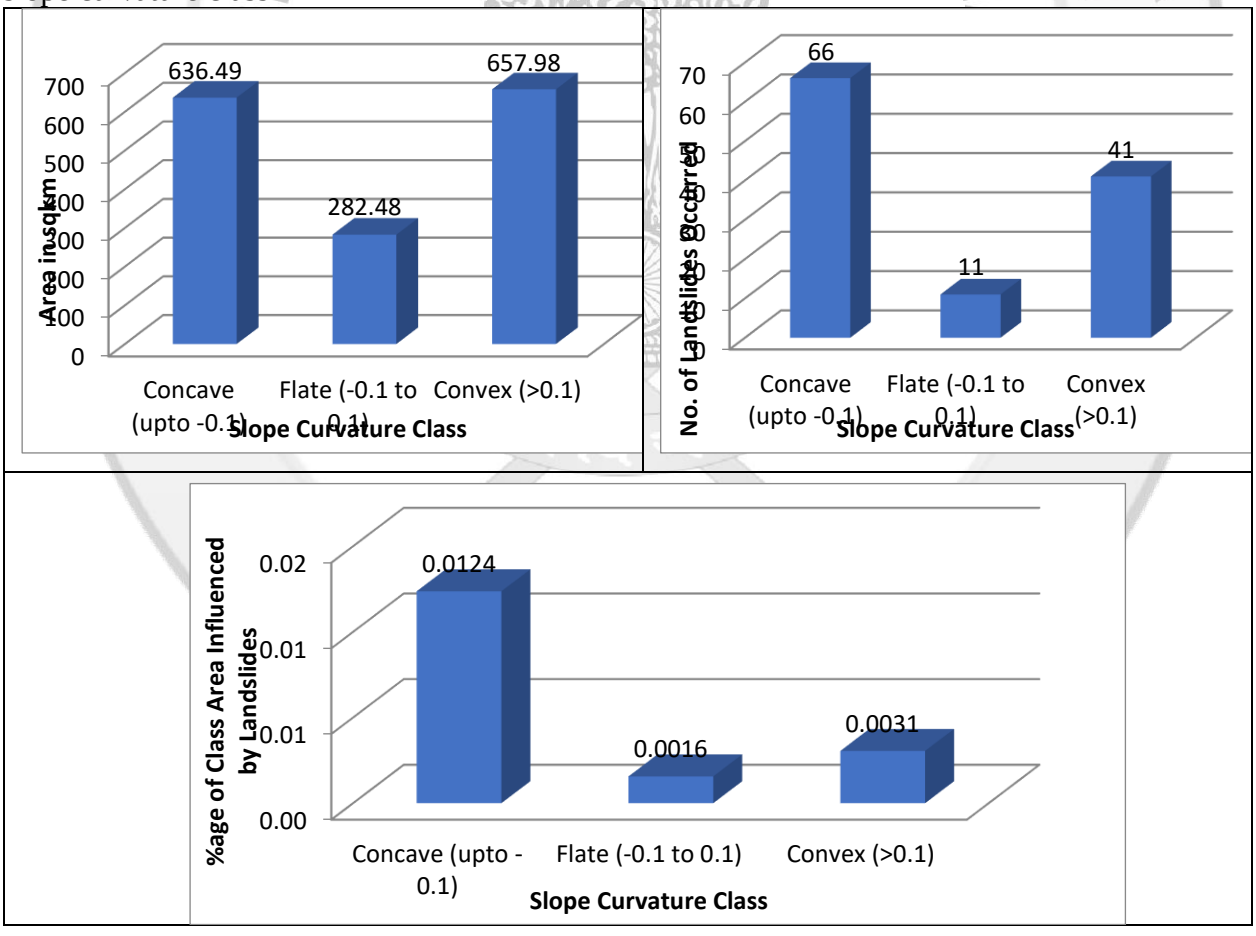
Slope Curvature- the curvature of a slope is defined as the rate of change of slope degree or aspect. A positive curvature represents upwardly convex surface, while a negative curvature indicates that the surface is upwardly concave at a given pixel (Kundu and Patel, 2019). Failures may be expected to occur more frequently in concave areas than the slopes that are convex along the contour. Curvature map is classified into three classes i.e. convex, flat and concave slopes. Convex slopes are prone to rock falls and many landslides caused by earthquakes, while concave slopes are prone to debris slides or flows along the valleys.

The Slope Curvature map is given in plate 5. The area mostly shows concave (636.49sq,km) and convex (657.98sq.km). About 18% of the area comes under the flat category. 66 landslides are observed along the concave slopes and the area of influence by landslides is also proportionately high (0.012), indicating landslides are more frequent within this class. The percentage of area influenced by landslides within the convex class is low (.003).

Table 4.2: Table showing area occupied by Curvature Classes

S. No	Curvature Class	Class Area (sqkm)	No. of Landslides Occurred	Area Cover by Landslides (sqkm)	%age of Class Area Influenced by Landslides	LOFS
1	Concave (upto -0.1)	636.4925	66	0.078728	0.012369038	0.4113
2	Flat (-0.1 to 0.1)	282.475	11	0.004417	0.001563678	0.1676
3	Convex (>0.1)	657.9825	41	0.020078	0.003051449	1.0000

Fig 4.2: Graph showing area occupied, number of landslides and influence by landslides for each slope curvature class

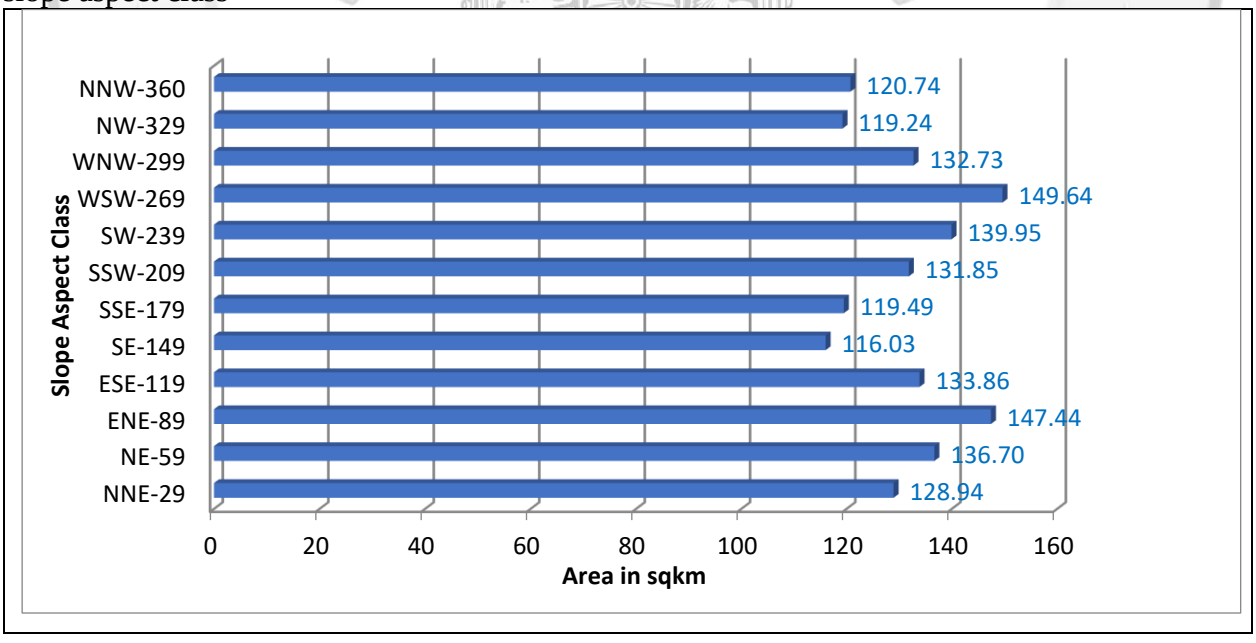


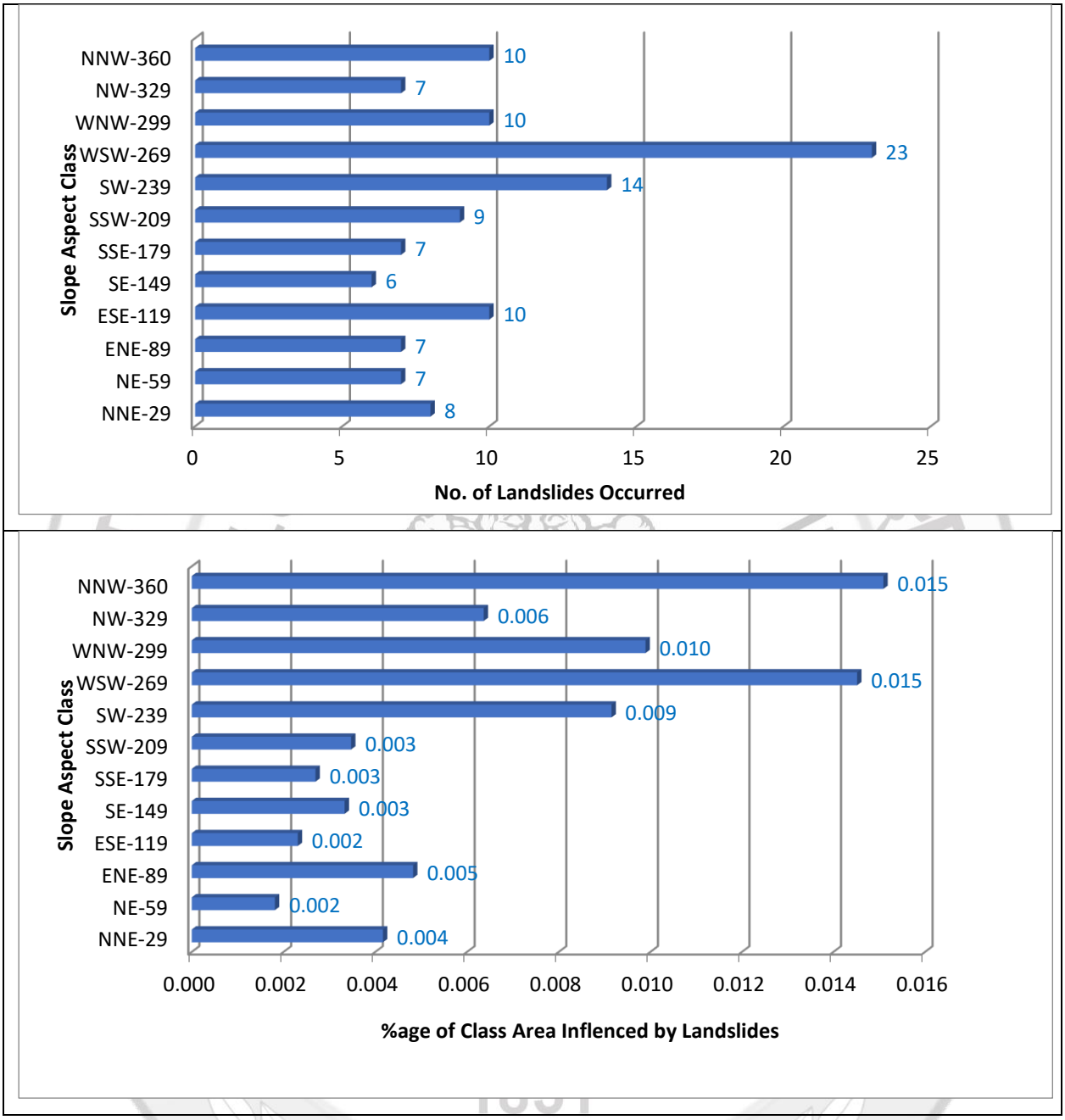
Slope Aspect- Slope aspect describes the direction of slope. The moisture retention and vegetation are generally reflected by the slope aspect which may affect soil strength and susceptibility to landslides (Kundu and Patel, 2019). Aspects are categorized into eight types: east, west, south, north, southeast, southwest, northeast and northwest. The map is given in Plate 6.

Table 4.3: Table showing area and distribution of landslides for Slope Aspect Classes

Value	Aspect Class	Class Area (sqkm)	No. of Landslides Occurred	Landslide Area (sqkm)	%age of Class Area Influenced by Landslides
1	NNE-29	128.935	8	0.005375	0.004168767
2	NE-59	136.6975	7	0.002478	0.001812762
3	ENE-89	147.44	7	0.007115	0.004825692
4	ESE-119	133.8625	10	0.003095	0.002312074
5	SE-149	116.03	6	0.003868	0.003333621
6	SSE-179	119.485	7	0.003224	0.002698247
7	SSW-209	131.85	9	0.004581	0.003474403
8	SW-239	139.9475	14	0.012812	0.009154862
9	WSW-269	149.64	23	0.021725	0.014518177
10	WNW-299	132.73	10	0.013135	0.00989603
11	NW-329	119.235	7	0.00759	0.006365581
12	NNW-360	120.7425	10	0.018224	0.015093277
Total		**1576.595**	**118**	**0.103222**	**0.07765349**

Fig 4.3: Graph showing area occupied, number of landslides and influence by landslides for each slope aspect class





The area occupied by each aspect class is nearly the same as observed from the Table and Fig. but it is evident from the area of influence map that the NNW and WSW direction facing slopes are influenced by landslides to a great extent (0.015%). The maximum number of landslides is also observed along the WSW direction. It is to be noted that aspect is not considered for generation of landslide susceptibility map.

4.2.2 Land use/land Cover

Land use and land cover (LU/LC) changes induced by human activity influence slope stability (Coco and Buccolini, 2015). Studies have proved that vegetated areas are less prone to landslides in compassion to barren areas or areas with sparse vegetation (Greenway 1987). Land cover protects and reduces the susceptibility of soil erosion and landslides, thereby reducing the effect of rainfall on the soils (Yalcin et al., 2008; Regmi et al, 2010). Thus, the slope stability of areas with complete vegetation cover is often higher than that of areas with scarce vegetation (Schmidt et al., 2001). The LULC map (Plate 7) was prepared on Arc-GIS platform through visual interpretations of multi temporal Google Earth satellite imagery.

The map generated was validated through field checks and the final map prepared. The land use/land cover of the area shows that the area is mainly occupied by dense vegetation (forest) in the northern part, with steep ridges and rivers flowing along deep valleys and moderate vegetation in the southern part. There are small patches of cultivated land within the vegetated area. The north western part of the area is under the Supa Dam reservoir. Settlements are observed in the vicinity of these cultivated patches. These settlements are accompanied by construction of roads, railways and reservoirs, which in turn have opened channels for exploitation and caused rapid changes in land use pattern of the area. This often results in slope cut failures, mostly along road. Extensive cuts slopes along the road and river, are formed either due to anthropogenic or under natural condition (toe erosion by streams). These areas are most vulnerable for slope failure.

71.5% (867.2sq.km) of the study area is occupied by thick vegetation, while 27% (427.9sq.km) comes under moderate vegetation. Most of landslides are observed on the moderate vegetation slopes in cultivated areas (40 landslides). The highly vegetated slopes are also affected by landslides (34 landslides). These slopes are being extensively modified for cultivation and settlements. Though extensive cut slopes form a very small part of the study area (0.0013%), they are highly vulnerable to landslides as indicated by their area influenced by landslides which is highest among the classes (0.13%).

Most of the landslides have resulted from slope cuts along the road for settlement and cultivation. The slopes have been modified not only for cultivation but also for settlements. Cultivated patches form almost 7% of the study area. They are observed as isolated patches within moderate and dense vegetation and in most cases bordering settlements. As such only 10 landslides

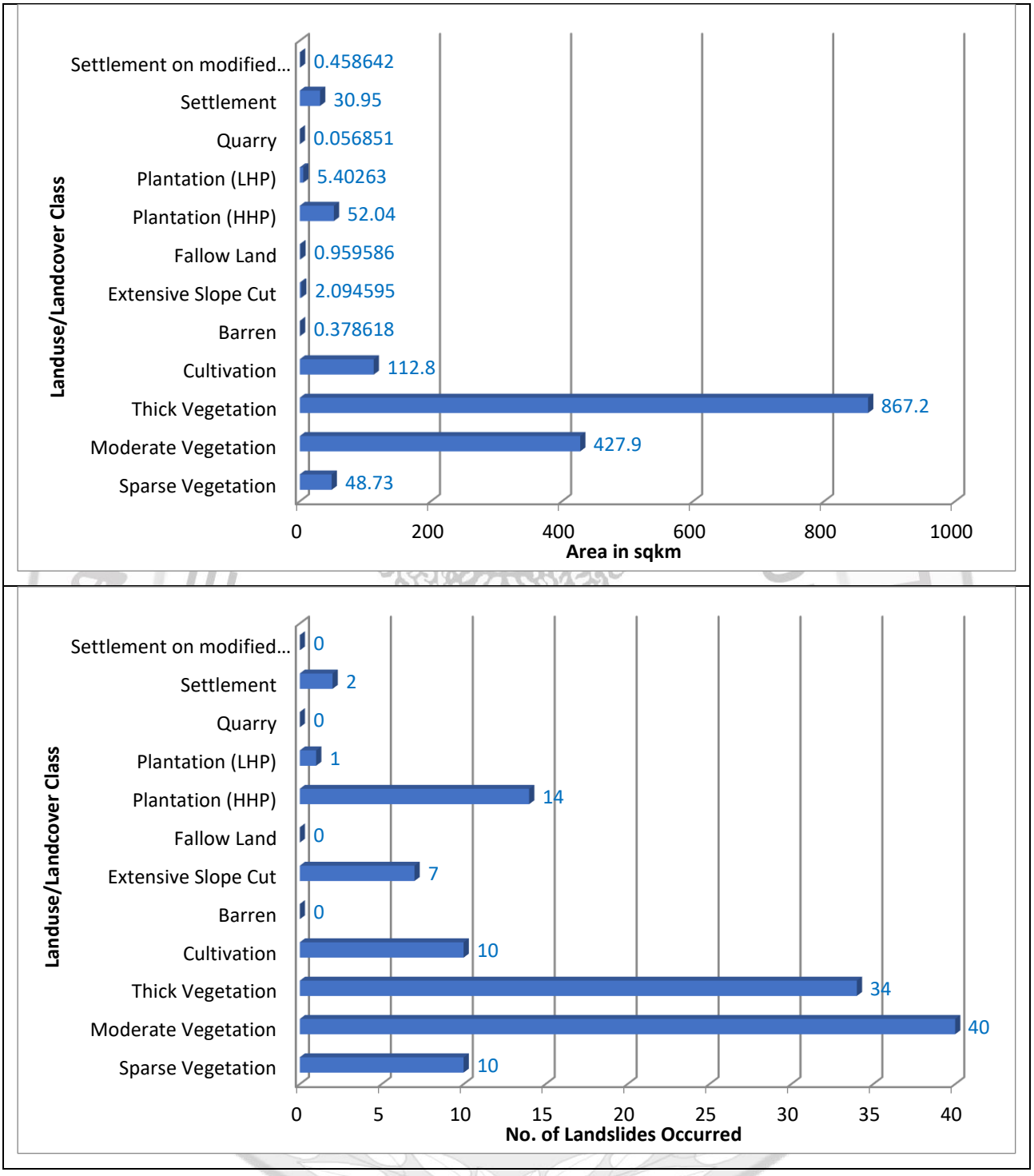
are observed within cultivation class. Landslides are mostly observed along the slopes bordering the cultivated areas. These slopes are actually part of the forests bordering the farms.

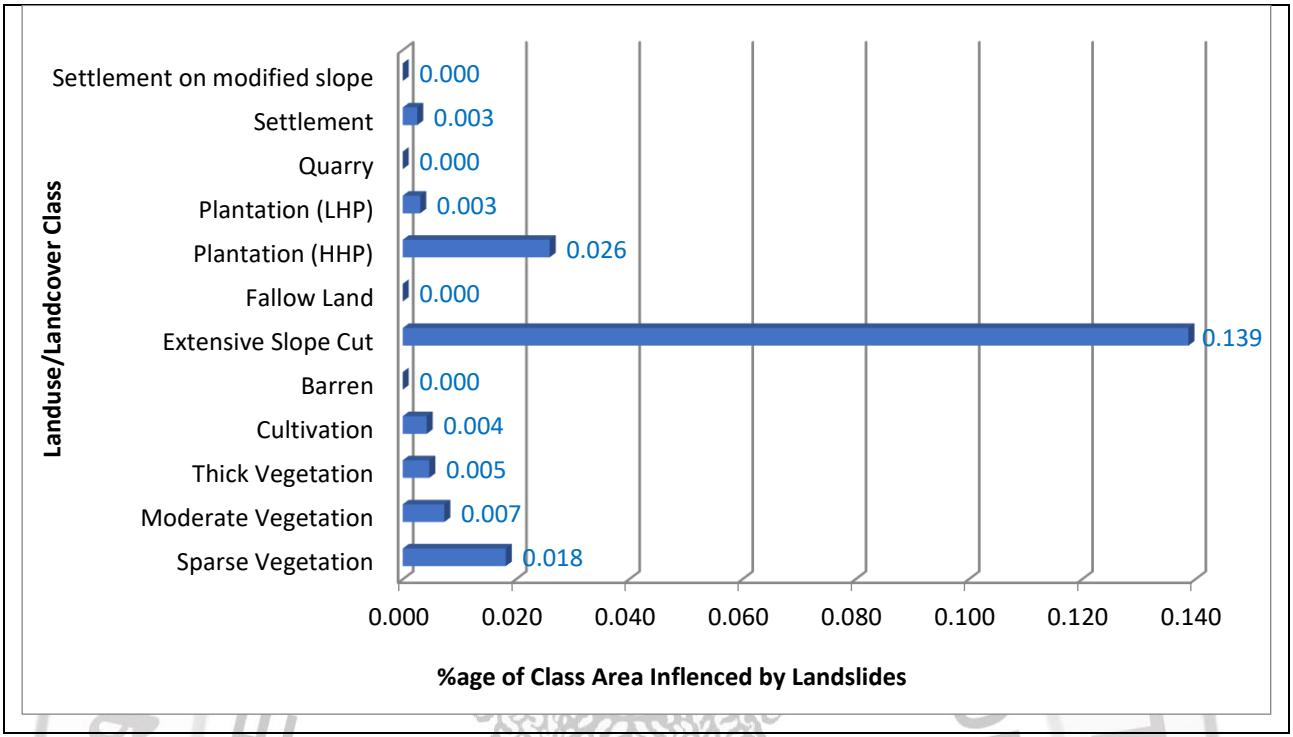
In plantation sites, landslides are common as people tend to remove soil from the slopes for agricultural purposes. Moreover, after landslides have occurred, the debris at the toe tends to stabilize the slope with time. But for renewing the fertility of the soil, people tend to remove soil from the debris, thereby making the slope more unstable.

Table 4.4: Table showing area and distribution of landslides for LULC Classes

SI. No	LULC Class	Class Area (sqkm)	No. of Landslides Occurred	Landslide Area (sqkm)	%age of Class Area Influenced by Landslides	LOFS
1	Sparse Vegetation	48.73	10	0.008882	0.018226965	0.5631
2	Moderate Vegetation	427.9	40	0.031441	0.007347745	0.2912
3	Thick Vegetation	867.2	34	0.040739	0.004697763	0.1988
4	Cultivation	112.8	10	0.004782	0.004239362	0.0937
5	Barren	0.378618	0	0	0	0.0626
6	Extensive Slope Cut	2.094595	7	0.002907	0.13878578	1.0000
7	Fallow Land	0.959586	0	0	0	0.0626
8	Plantation (HHP)	52.04	14	0.013515	0.025970407	0.1988
9	Plantation (LHP)	5.40263	1	0.000167	0.003091087	0.1366
10	Quarry	0.056851	0	0	0	0.2912
11	Settlement	30.95	2	0.000792	0.002558966	0.0683
12	Settlement on modified slope	0.458642	0	0	0	0.5631
13	River	12.4	0	0	0	0.0000
14	Water body	15.35	0	0	0	0.0000

Fig 4.4: Graph showing area occupied, number of landslides and influence by landslides for each LULC class


Landuse/Landcover Class
Settlement on modified...
Settlement
Quarry
Plantation (LHP)
Plantation (HHP)
Fallow Land
Extensive Slope Cut
Barren
Cultivation
Thick Vegetation
Moderate Vegetation
Sparse Vegetation
0.458642
30.95
0.056851
5.40263
52.04
0.959586
2.094595
0.378618
112.8
867.2
427.9
48.73
0
200
400
600
800
1000
Area in sqkm
Landuse/Landcover Class
Settlement on modified...
Settlement
Quarry
Plantation (LHP)
Plantation (HHP)
Fallow Land
Extensive Slope Cut
Barren
Cultivation
Thick Vegetation
Moderate Vegetation
Sparse Vegetation
0
2
0
1
14
0
7
0
10
34
40
10
0
5
10
15
20
25
30
35
40
No. of Landslides Occurred



4.2.3 Geomorphology

The geomorphology map was prepared on Arc-GIS platform through visual interpretations of multi temporal Google Earth satellite imagery. The map generated was validated though field checks and the final map prepared (Plate 8). The area was grouped into the following classes' namely highly dissected slopes, moderately dissected slopes, lowly dissected slopes, Piedmont slope, valley fill, pediment-pediplain complex, rolling plains and alluvial plain. The dissected slopes (high, moderate or low) are marked based on visual interpretation by taking into consideration the topographic ruggedness and presence of drainage.

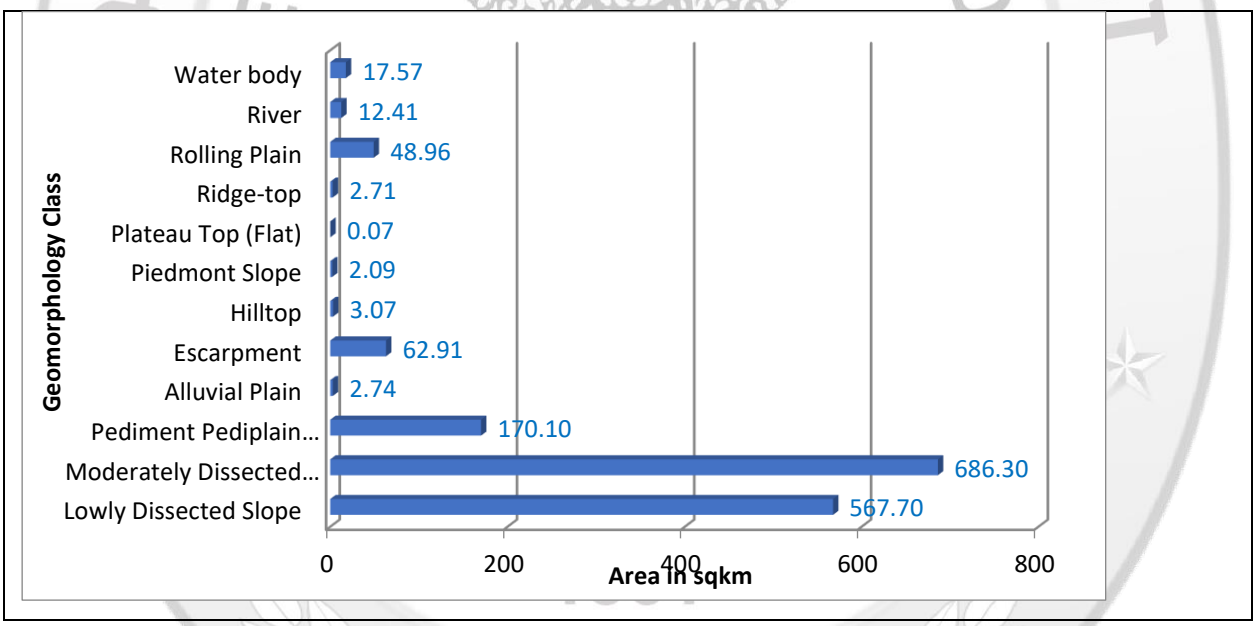
The area is occupied mostly by lowly dissected to moderately dissected hills, surrounded by rolling plain.

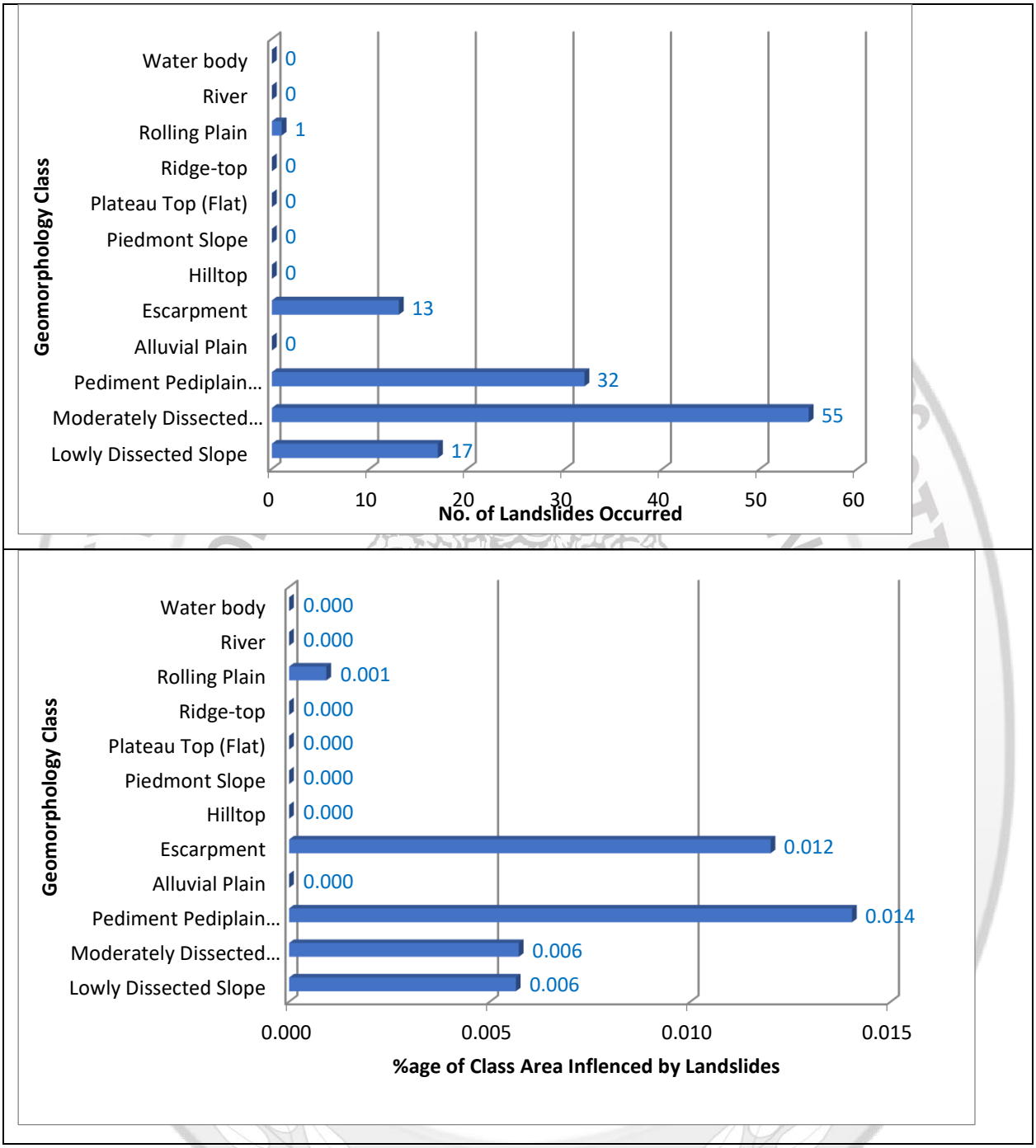
Table 4.5: Table showing area and distribution of landslides for Geomorphology Classes

Sl. No.	Geomorphology Class	Rank	Class Area (sq.km)	No. of Landslides Occurred	Land slide Area (sq.km)	%age of Class Area Influenced by Landslides	LOFS
1	Lowly dissected slope	4	567.7	17	0.032072	0.005649463	0.1947
2	Moderately dissected slope	6	686.3	55	0.039272	0.005722279	0.4020

3	Pediment pediplain complex	0	170.1	32	0.023873	0.014034685	1.0000
4	Colluvial Foot slope	3	2.742935	0	0	0	0.2817
5	Escarpment	9	62.91	13	0.007552	0.012004451	0.0819
6	Hilltop	0	3.06677	**0**	**0**	0	0.0000
7	Plateau Top (Flat)	0	2.086978	0	0	0	0.1947
8	Ridge-top	0	0.073808	0	0	0	0.0000
9	Rolling plain	0	2.714627	0	0	0	0.0000
10	River	0	48.96	1	0.000454	0.000927288	0.0000
11	Water body	0	12.41	0	0	0	0.0000

Fig 4.5: Graph showing area occupied, number of landslides and influence by landslides for each Geomorphology class





43.5% (686.3sq.km) of the area is occupied by moderately dissected slopes, while 36% (567.7sq.km) of the area falls under the lowly dissected category. Landslides are more predominant in these classes as these slopes are extensively modified for agricultural activities and settlements. The low lying areas in an around Sirsi come under the lowly dissected area, where the stream

density is also very low. Near Dandeli, the terrain is moderately dissected. Pediment pediplain complex forms 11% of the area. Escarpments form a small (4%) but significant part. In the vicinity of Ambikanagar village, most of the landslides have given rise to escarpments. The road is along a ghat section and hence it is affected by landslides and road cuts have also led to sliding triggered by rainfall. The banks of the Bedthi River in the western part of the study area and the Kali River are marked by escarpments. Ridge tops are observed to the west of Sangve and Kulgi villages. Most of the landslide incidences are observed within the moderately dissected terrains near Sirsi and Dandeli.

46% (55 landslides) are observed within the moderately dissected slopes and 27% (32 landslides) within the PPC. As dissection of a slope is measured in terms of stream density as well, the landslides along moderately dissected slopes are observed to be due to toe erosion of the slope by streams. 17 landslides are observed within the lowly dissected slope and 13 are observed within escarpments. The area influenced by landslides is highest for PPC (0.014), followed by escarpments (0.012). In comparison with the area occupied by these classes, the number of landslides is very much high.

4.2.4 Slope Forming Material

The materials present on denudational hill slopes and escarpments have lower cohesion and hence are more prone to failure. The slope stability depends on the physical and mechanical properties of the material forming the slope, which in turn depends on the climatic conditions and slope morphometry. Slope Forming Material (SFM) (**PLATE 9**) map was prepared in Arc-GIS through visual interpretation of multi-temporal Google Imageries of the area and collection of data for material present on slopes. The study area in terms of Slope Forming Material (SFM) is classified in to the following classes: Rock, Weathered rock, transported soil, alluvium and in-situ soil. The geology, geomorphology, LULC and slope maps are used for the preparation of the pre-field SFM maps. During field validation, the depth of overburden, its composition is all noted and the SFM modified accordingly. Using landforms as proxies, the subjective soil/overburden thickness map was first prepared, since those proxies can easily be mapped on1:50,000 scales using remote sensing data. Then the same is modified further using thickness data obtained from the field. In the study area the slope forming material classes are identified as in-situ soil, weathered rock, rock, transported soil and alluvium**.**

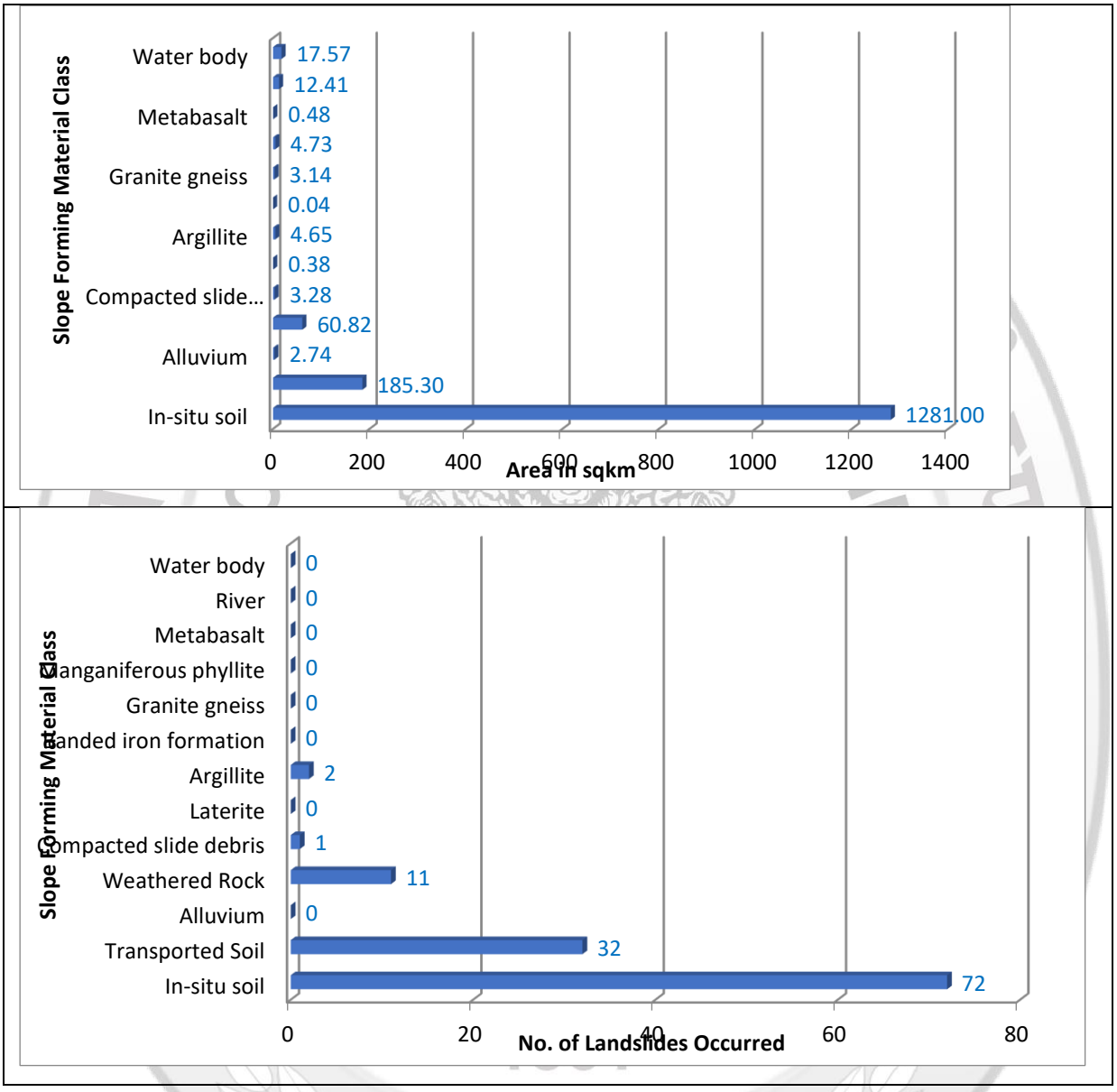
Incessant rainfall during the monsoons, combined with tropical climate has created ample conditions for rock weathering. As most of the slopes are quite gentle, the weathered material is rarely transported, leading to good development of in-situ soil in the area. A major part of the study area is occupied by in-situ soil. The soil thickness is between 2-3 metre, as observed in field. Transported soil is observed along the stream channels and in cultivated patches modified from minor streams. Rock exposures are very few, and usually exposed along escarpments and certain hilltops.

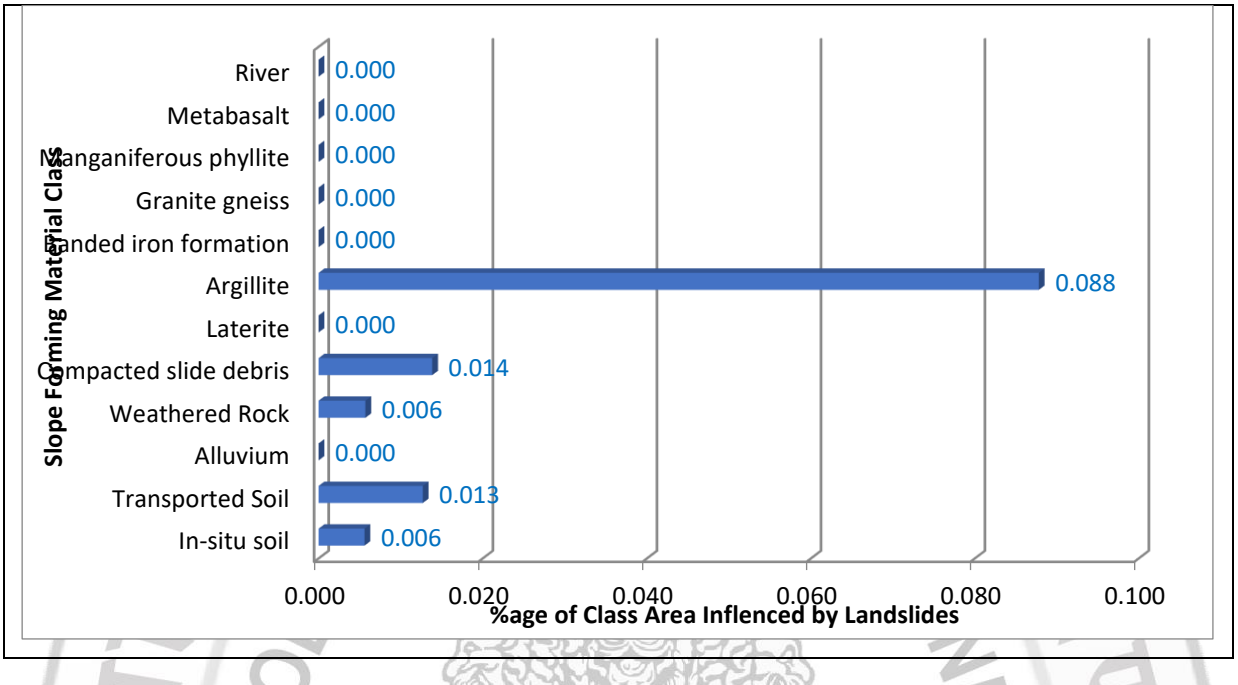
In-situ soil occupies 81% (1281 sq,km) of the area and most of the landslides occur within this class (72 landslides). Cultivation and plantations are present on in-situ soil. As weathering index is high, soil is observed in most places. On enquiring with locals, soil cover is quite thick is most areas, at places >10m. Among the rock units, argillite is most vulnerable to weathering and most prone to landslides. The landslide influence is also gigh within the argillites. In places it is observed that landslides tend to recur seasonally. Within compacted debris landslides are observed.

Table 4.6: Table showing area and distribution of landslides for slope forming material class

Id	SFM Class	Class Area (sqkm)	No. of Landslides Occurred	Landslide Area (sqkm)	%age of Class Area Influenced by Landslides	LOFS
1	In-situ soil	1281	72	0.071695	0.005596799	0.2409
2	Transported Soil	185.3	32	0.023522	0.01269401	0.1506
3	Alluvium	2.743465	0	0	0	0.0000
4	Weathered Rock	60.82	11	0.00347	0.00570536	0.5437
5	Compacted slide debris	3.280306	1	0.000454	0.013840172	0.1506
6	Laterite	0.376548	0	0	0	0.2409
7	Argillite	4.648539	2	0.004082	0.087812536	0.2409
8	Banded iron formation	0.037285	0	0	0	0.0682
9	Granite gneiss	3.143274	0	0	0	0.0682
10	Manganiferous phyllite	4.727361	0	0	0	0.2409
11	Metabasalt	0.478121	0	0	0	0.0682
12	River	12.41	0	0	0	0.0000
13	Water body	17.57	0	0	0	0.0000
	Total	**1576.534899**	**118**	**0.103223**	**0.125648878**	**2.0131**

Fig: Graph showing area occupied, number of landslides and influence by landslides for each SFM class





4.2.5 Regolith Thickness Material

Regolith refers to the material, lying over the fresh country rock including both in-situ or transported soil and weathered mass. Regolith thickness is an important factor influencing landslides. Slopes failures occur when there is a decrease in shear strength of the soil due to increase in pore water pressure on the failure surface. Pore water pressure increase can be caused by infiltrating rainwater or by accumulation of water at depths due to the presence of an impervious layer at depth. Analysis by Basharat et al, (2018), shows that most of landslides were located within 1–5 m regolith thickness. This is also because, most of the study area was occupied by soil having that thickness.

. Preferably, for thickness modeling, a large number of observations (such as drill holes, outcrops or geophysical measurements) are required. However, at the current level it is difficult for such methods to be adopted. Regolith thickness map was prepared based on field observations. During field work, regolith/overburden thickness is estimated by observing road cuts, forest trenches and nala sections wherever available. An attempt is made to get the approximate overburden depth and it is observed that in low dissected hill slope with low slope gradient, the overburden depth is relatively more.

Most of the area is occupied by regolith with >10m thickness (78%~1244 sq.km). Tropical climate accompanied by intense monsoons aid in exceptional development of soil and luxurious

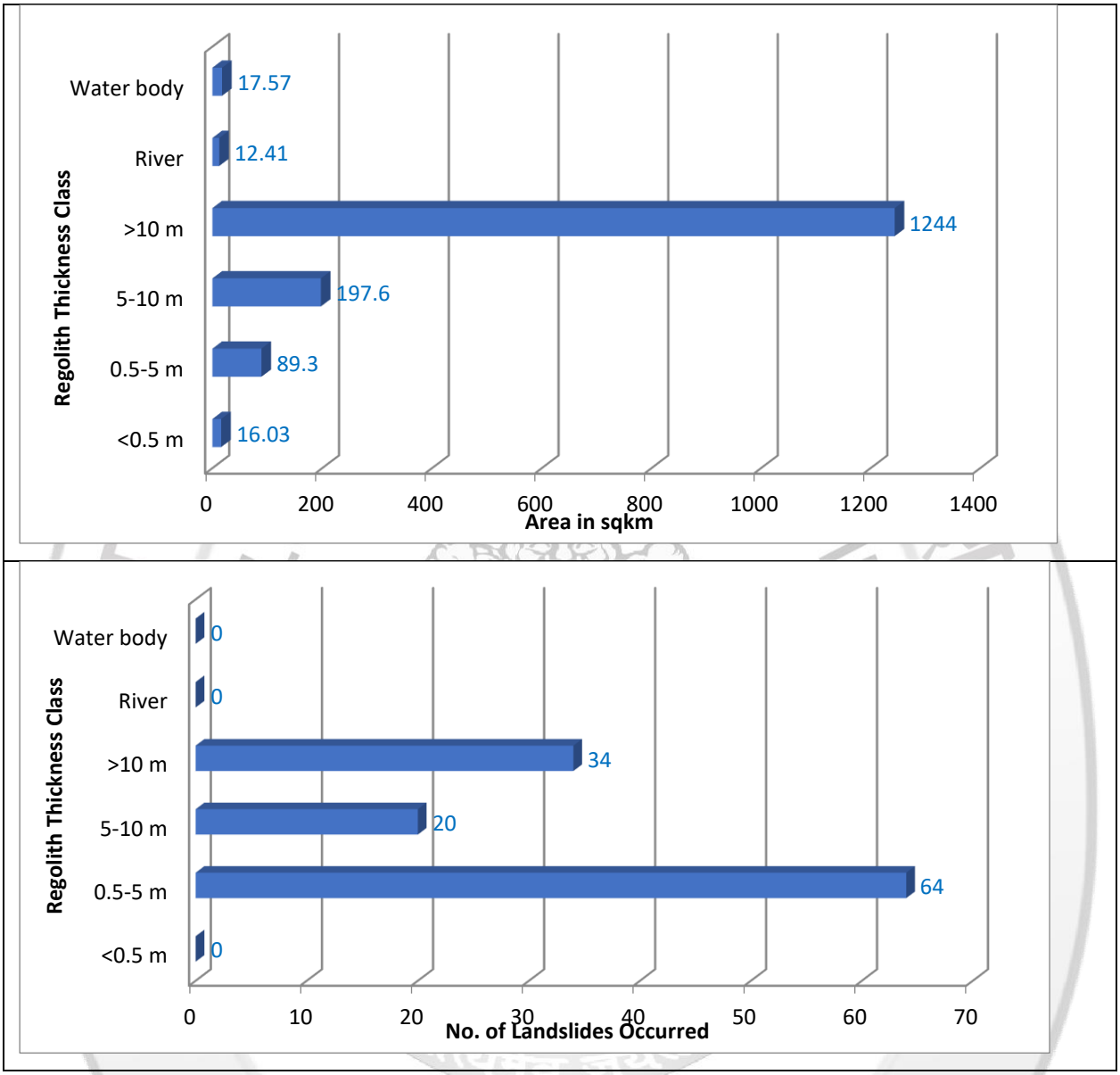
vegetation. Moderate to thick vegetation occupies almost 80% of the study area. Slopes and hill tops are rarely observed devoid of vegetation. Rocks slopes and barren hilltops come under the class <0.5m thickness. As such only 2-3 small scale rock slides were observed in the area. A very small area (16.03sq.km) is occupied by the class. As cultivation is prevalent in the area, it is observed that the overburden thickness is greater along cultivated patches, especially along those patched that were modified from minor streams. As the flood plain material is added along the banks every year, the thickness of soil column also increases.

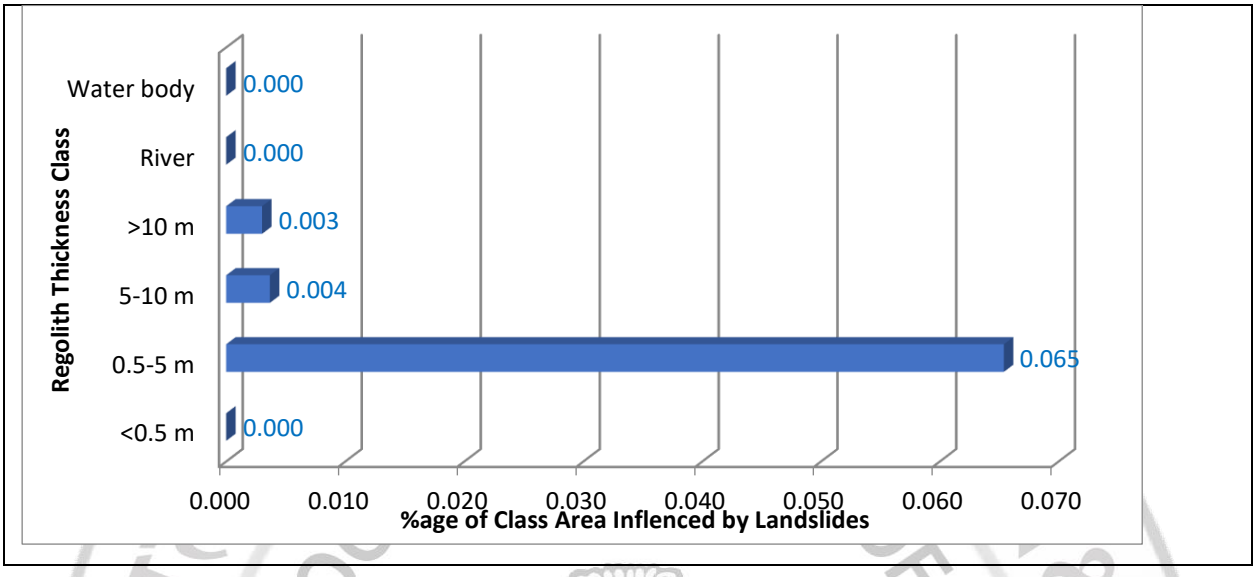
Most of the landslides are observed within the 0.5-5m class. The influence of landslide on class area is also greatest for this class. Though the class occupies a very small area, it is highly prone to slope failure.

Table 4.7: Table showing area and distribution of landslides for regolith thickness class

Id	RT Thickness Class	Class Area (sqkm)	No. of Landslides Occurred	Landslide Area (sqkm)	%age of Class Area Influenced by Landslides	LOFS
1	<0.5 m	16.03	0	0	0	0.0000
2	0.5-5 m	89.3	64	0.058403	0.065400896	1.0000
3	5-10 m	197.6	20	0.007262	0.003675101	0.3230
4	>10 m	1244	34	0.037558	0.003019132	0.1363
5	River	12.41	0	0	0	0.0000
6	Water body	17.57	0	0	0	0.0000
	Total	**1576.91**	**118**	**0.103223**	**0.072095129**	**1.45923**

Fig 4.7: Graph showing area occupied, number of landslides and influence by landslides for each regolith thickness class


Water body
River
>10 m
5-10 m
0.5-5 m
<0.5 m
Regolith Thickness Class
17.57
12.41
1244
197.6
89.3
16.03
0
200
400
600
800
1000
1200
1400
Area in sqkm
Water body
River
>10 m
5-10 m
0.5-5 m
<0.5 m
Regolith Thickness Class
0
0
34
20
64
0
0
10
20
30
40
50
60
70
No. of Landslides Occurred



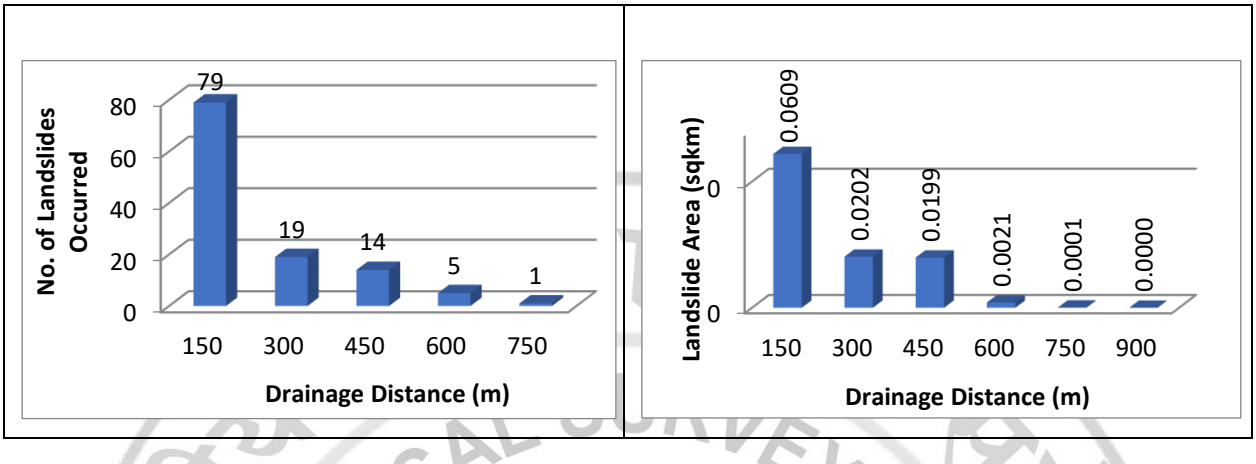
4.2.6 Drainage

The landscape of any area is influenced and shaped by the drainage flowing through it. In the area it is seen that most of the landslides are observed on first or second order streams. The streams tend to erode the base of the slope, thereby making the upper slope unstable. This leads to slope failures. It is observed that almost 66% of the landslides occur within 150m buffer zone of the drainage (79), indicating the area adjacent to the streams is most vulnerable. 19% landslides occur within the zone between 150 to 300m. The further we move away from the streams, the incidences of landslides are very less. It is to be noted that drainage is not considered as a factor for landslide susceptibility map generation.

Table 4.8: Landslide occurrence with respect to distance from the stream

Drainage Distance	No. of Landslides Occurred	Landslide Area (sqkm)
150	79	0.060935
300	19	0.02022
450	14	0.019884
600	5	0.002086
750	1	0.000097
900	0	0
	118	**0.103222**

Fig 4.8: Graphical representation of number and area occupied by landslides with respect to distance from the drainage.



4.3 Landslide susceptibility analysis

Landslide susceptibility refers the probability of a landslide occurrence in an area. A map depicting the susceptibility will have values from low to high susceptibility and give an idea about the geographical location where a landslide may occur. At the same time, an area having high susceptibility does not mean that landslides occurrences will be restricted only to that area and similarly low susceptibility doesn't imply that landslides will never occur in the area. Mathematically, landslide susceptibility refers to the probability of spatial occurrence of known slope failures, given a set of geo-environmental conditions (Guzzetti et al., 2005)

Landslide Susceptibility Analysis is carried out on the basis of AHP method for spatial prediction of landslide-prone areas and the final susceptible map of the area is demarcated or classified as low, moderate and highly susceptible areas where possibility of landslide occurrences in near future is expected.

Methodology

Many methods have been proposed to evaluate landslide susceptibility at the basin scale, including direct geomorphological mapping, heuristic approaches, statistical classification methods and physically based models. Analytical hierarchy processes are considered for the preparation of landslide susceptibility maps due to limitations in number of slides and insufficient landslide datasets for a data driven model. As landslide inventories are not available for all areas, this knowledge-driven ratings/ weights in quantitative matrices can easily be determined mathematically using AHP (Saaty, 1987; Ghosh et al., 2011), after preparing/ deciding on the qualitative pair-wise importance matrix for different geo-factor classes and amongst different geo-

factors for inter-predictor weights, obtained so far through discussion and comments received from local experts and landslide scientists engaged in landslide investigation of the area.

Methodology for landslide susceptibility mapping is divided as

1. Preparation of landslide inventory

The aim of a landslide susceptibility map is to identify locations where landslides are likely to occur in future, based on the fundamental assumption that spatial factors that caused present and past landslides are likely to cause similar landslides in the future. According to Guzzetti et al. (1999), landslides that occurred in the past and present are keys to predicting landslides that may happen in the future. Therefore, the first step in any landslide susceptibility investigation is to compile the known/ existing landslide inventory data available. All data, related maps, reports, remote sensing data are taken into consideration while collecting data. All this is then compiled in the form of a database and map for validation.

2. Roles of geofactors in landsliding and preparation of its related GIS-based database

A landslide is dependent on a number of factors. Any one or all of these factors in combination have the ability to influence a slope failure. These factors have to be mapped spatially and stored in a GIS based system as a spatial database. Any landslide model requires certain parameters/geofactors which act as an input for the model to run. Based on the availability of data, geo-factors are selected and the respective thematic maps are prepared. For the current modeling,the slope morphometry, LULC, geomorphology, regolith thickness and slope forming material are considered. The thematic maps are prepared on any GIS based software. The DEM derivative maps are extracted from Aster/CARTO DEM of 30m resolution. These maps are then resampled to 50m resolution for overlay analysis of the various thematic maps.as the basic unit of mapping in case of landslide susceptibility modelling is a pixel, the smallest landslide is represented by a single pixel of 50x50m and anything smaller than this is not considered for modeling. The necessity of quantitative spatial association analyses in any form of predictive modeling is to select only the good predictors, ie those geofactors which have a positive association with the existing landslides.

3. Empirical selection or spatial association analysis between various geofactors and landslides for determining both ratings of factor classes and weights of the geofactor themes.

The geo factors selected are divided into classes and each of these classes is assigned a specific rating (Annexure 2). Each individual geofactor is also assigned a weightage. While giving the semi-quantitative rating in a scale of 1-9 for each geofactor theme, the mutual relative importance for influencing/ causing a single proposition that is land sliding in this case should be taken into account. A particular geo-factor class having higher rating would be considered as more influential in triggering a landslide. After selection of such predictors, the next step is to objectively determine their inter-predictor weights and then combine the selected predictors with their weights in a suitable susceptibility model like Weighted Multiclass Index Overlay

4. GIS-based modeling for integration of selected and weighted geofactor maps for preparation of landslide susceptibility scores

The concept of Analytical Hierarchy Process (AHP) was first developed by Saaty (1977) for pair wise analysis of priorities in multi criteria decision making. Complex decisions are reduced to a series of pair wise comparisons and then the results are synthesized, thereby capturing both the subjective and objective aspects of a decision. The Analytical Hierarchy Process- AHP provides measures of judgment consistency, derives priorities among criteria and alternatives, and simplifies preference ratings among decision criteria using pair wise comparisons to establish priorities among the elements to obtain the set of overall or weights for achieving, evaluating and checking the consistency of judgments. Predictive modeling of susceptibility to landslides aims to make an approximation at every location in the study area regarding the future occurrence of such landslides based on already known occurrence of landslides. The analysis thus assumes that the relations between spatial factors and past landslides are relevant to the occurrence of future landslides. Therefore, to effectively model the land sliding phenomenon, landslide incidences, controlling geo factors, their mutual importance in influencing landslides is taken into account (Table 4.5).

5. Validation and classification of landslide susceptibility score maps into qualitative maps showing varying degree of landslide susceptibility-

Validation is an important part of any predictive mapping. It is not just enough to validate the landslide susceptibility map by overlaying it with the landslide incidence map, certain validation techniques may be applied to check the accuracy of the data. The application of well-established cutoff-independent empirical validation techniques such as preparation of Success/ Prediction rate curves (Chung and Fabbri, 1999; Chung and Fabbri, 2003), Receiver Operating

Characteristic (ROC) curves (Hanley and McNeil, 1982) could be used as relevant effective quantitative tools for validation and classification of landslide susceptibility maps (Ghosh et al., 2011).

The AHP method is appropriate to be used where decisions are to be assessed quantitatively. It is assumed that human beings‟ natural reaction when facing a complex decision making process, is by grouping the decision elements according to common characteristics. This involves ranking the decision elements, and then comparing between each pair in each group in a form of matrix. Then inconsistency ratio and weight for each element can be measured. This provides ease in testing the data consistency. The higher consistency ratio, the assessment result becomes more inconsistent. The acceptable consistency ratio is less than or equal to 10%. According to Taylor, Consistency Index (CI) can be calculated by using the following formula: CI= maks eigen value-n/n-1 Eq-1 ι∑=maks.eigenvalue wi.ci Eq-2 The consistency ratio is then calculated as, CR= CI/ RI Eq-3 Where, n is the amount of items compared, wi is the weight, ci is the sum of column, CR is the Consistency Ratio, CI is the Consistency Index and RI is the Random Consistency Index. If CR ≥ 10%, the data acquired is inconsistent and If CR < 10%, the data acquired is consistent. The ratio-scale form is used as an input. The values in the ratio are organized in a matrix, which is called the pairwise comparison matrix. In the AHP method, the scale range 1– 9 is assumed. It is limited to a ratio-scale 1–9 because according to the research conducted by Miller, human beings cannot simultaneously compare more than seven objects.

Classification of the Landslide Susceptibility Map into High, Moderate and Low Susceptible zones.

The ratings for each decision alternative for each criterion is developed by

- developing apair wise comparison matrix for each criterion
- normalizing the resulting matrix
- averaging the values in each row to get the corresponding rating
- calculating and checking the consistency ratio.

The weighted average rating for each decision alternative is calculated and the one with the highest score is chosen. Then the pair wise comparison matrix is prepared, where the rows and columns of each criterion are compared. The matrix is then normalized by totaling the numbers in each column and then the entry in each column is divided by the total obtained to yield a

normalized score. The total of each column is 1 after normalization. The consistency of the data is to be checked. The inconsistency ratio and weights for element is measured, as it provides ease in testing the data consistency. The higher consistency ratio, the assessment result becomes more inconsistent. The acceptable consistency ratio is less than or equal to 10%.

According to Taylor, Consistency Index (CI) can be calculated by using the following formula:

$$CI = \lambda max - n / n - 1$$
$$CR = CI / RI$$

n	1	2	3	4	5	6	7	8	9
RI	0	0	0.58	0.9	1.12	1.24	1.32	1.41	1.46

n = order of matrix, Random inconsistency indices for n = 10 (Saaty, 1980)

In the AHP method, the scale range 1–9 is assumed. It is limited to a ratio-scale 1–9 because according to the research conducted by Miller, human beings cannot simultaneously compare more than seven objects The standard preference scale was used by Miller is as follows:

Table 4.9 : Class value and their ratings as per Miller

Preference Level	**Numerical Value**
Equally Preferred	1
Equally to Moderately Preferred	2
Moderately Preferred	3
Moderately to Strong Preferred	4
Strongly Preferred	5
Strongly to Very Strongly Preferred	6
Very Strongly Preferred	7
Very Strongly to Extremely Preferred	8
Extremely Preferred	9

The ratings for individual factor classes and weights for each map is prepared in MS-Excel. Based on pair wise matrix comparison of each factor class for all geofactor thematic maps, calculation of Eigen values, fraction rate values and Landslide Occurrence Favourability Score (LOFS) rating was obtained. The LOFS ratings calculated for all classes of the geo-factor thematic maps are given below. The excel table is joined with the factor maps using “Table Join & Relate” function in Arc GIS. LOFS rating maps are generated for each geofactor thematic map using

Lookup" function in Reclassify tool of Arc GIS. This gives the spatial distribution of LOFS values. Using "Map Algebra" function of Spatial Analyst Tool in Arc GIS rating maps were combined together to obtain landslide susceptibility score maps. Classification break values were determined on the basis of logic of providing mutual comparison expert-driven ranking to sub-divide the score map. Considering rank value of '5' in a scale of '0 to 9' has higher likelihood in influencing landslides which comes after 50% of absolute difference values, similarly rank value of '≤3' has least likelihood in influencing landslides comes after 30% of absolute difference value. Hence, 50% cut-off margin or weightage was used to determine the break raster value between "Moderate" and "High" susceptibility classes, while 30% cut-off margin or weightage was used between "Low" and "Moderate" susceptibility classes.

Chapter 5

Landslide Susceptibility Analysis

Landslide susceptibility mapping is carried out with an aim to differentiate an area into standardized zones according to their probability of failure caused by mass-movement at specific locations (Varnes, 1978). Landslide susceptibility analysis was carried out in parts of toposheets 48I/12, I/16, 48J/13 and J/14 using Weighted Multiclass Index Overlay method of data integration and AHP based mathematical modeling. The susceptibility is expressed in terms of relative likelihood for the initiation of any landslide under given conditions. It is to be noted that the susceptibility map is generated for a given set of parameters and any change in the parameters spatially will also affect the relative susceptibility of the area. The

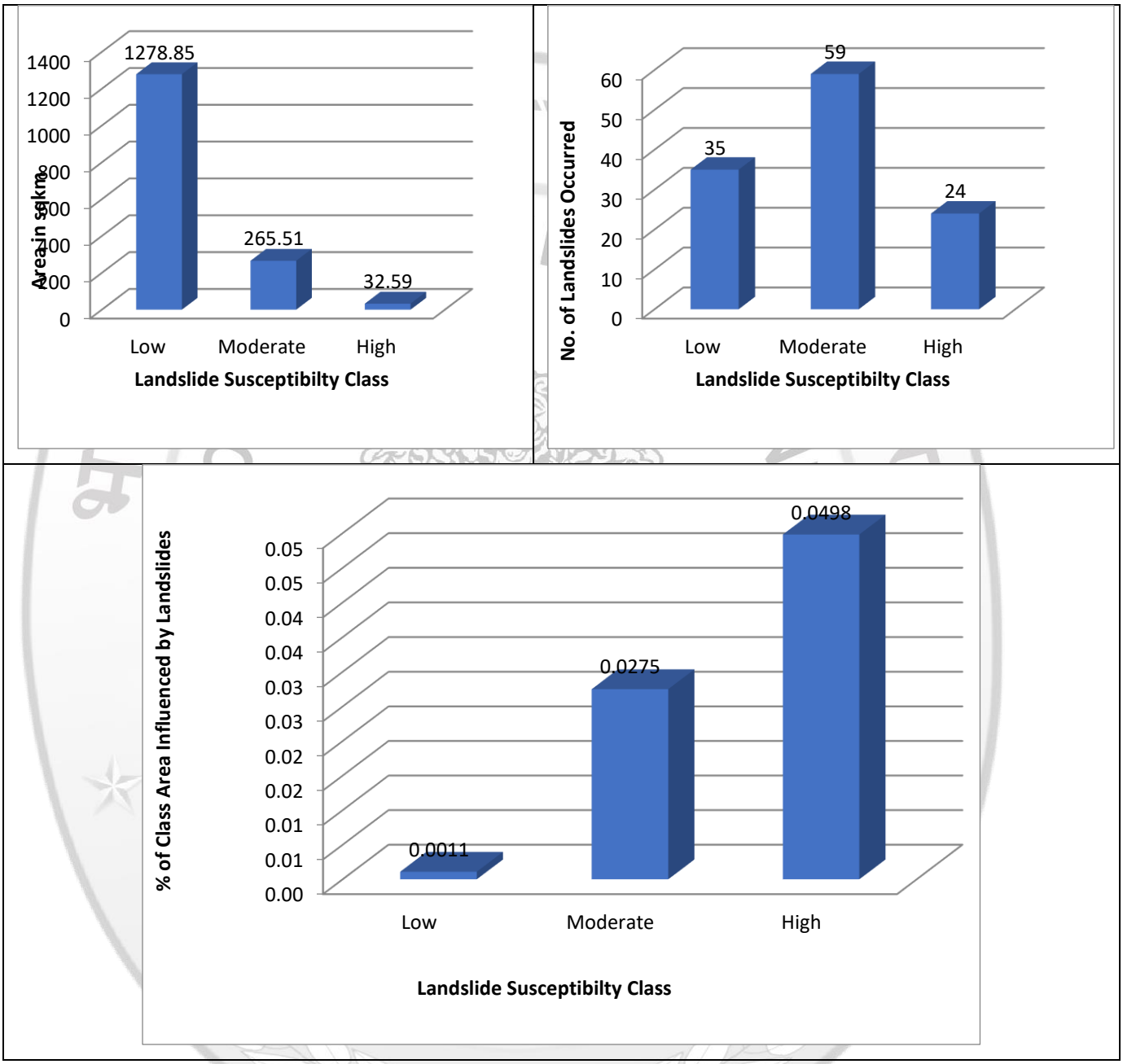
As per the final susceptibility map, it is observed that almost 81% (1279sq.km) of the area falls under the low landslide susceptibility zone. 17% (266sq.km) of the area comes under the moderate susceptibility zone, whole 2% (33sq.km) falls under the high susceptibility zone.

Table 5.1 : Table showing area and distribution of landslides for susceptibility class

Value	Landslide Susceptibility Class	Class Area (sqkm)	No. of Landslides Occurred	Landslide Area (sqkm)	% of Class Area Influenced by Landslides
1	Low	1278.8525	35	0.013991	0.001094028
2	Moderate	265.5075	59	0.073001	0.027494892
3	High	32.59	24	0.016232	0.049806689
Total		**1576.95**	**118**	**0.103224**	**0.078395609**

Maximum landslides are observed within the moderate (59 landslides) and low (35 landslides) susceptible zones. But when the area under a class is compared to the landslide area, it is clear that the high susceptibility class is most influenced by landslides (0.498%). There are 24 landslides (0.0162 sq.km) within 32.59 sq.km, indicating the area is indeed highly prone to landslides. The influence of landslides on the area for low susceptibility class is very low (0.001%), while the moderately susceptible class is more influenced by landslides (0.027%).

Fig 5.1: Graph showing the area occupied, number of landslides and class area of influence of landslides for each susceptibility class.



The high susceptibility zone is mainly along the Ghat section near the KPCL power house Ambikanagar, the steep road cuts near Kanchimane, and along the gorge near Bedthi River west of Chikkoti. All along the Road to the KPCL powerhouse near Ambikanagar, there are extensive cut slopes given for the construction of roads. The area is densely vegetated with huge trees, as a result of whch, there is loading on the head of the slope as well as increased root penetration, which

further increases the vulnerability of the slope. Highly jointed meta argillite further adds to chances of slope failure. The ridge tops near Sangve have also been marked as highly susceptible. This is due to the presence of numerous escarpments all along the slope. The road from Dandeli to Sangve is also highly susceptible to failure, as the road cuts are extremely steep, and the litho units forming the slopes are mainly meta argillite and managaniferous phyllite, both of which are easily weathered. The area is densely vegetated. Though vegetation aids in stabilizing the slope, in cases where big trees are present, the roots tend to deeply penetrate the slope. This increases the chances of water infiltration during rainfall. Moreover, when slopes having huge trees are given steep and extensive cut slopes, the chances of failure increase considerably.

The area along the Bedthi River course is another are under the highly susceptible class, which is mostly inaccessible. The river flows through deep gorges with escarpments. Few landslides have been marked, mainly as offsite locations.

The area around Kanchimane, south of Sirsi, is quite different from the adjoining areas. The area is marked by dense vegetation on steep slopes, with narrow valleys. Isolated patches of cultivation are present with settlements nearby. The roads built to access these settlements are constructed making near vertical cuts into the already steep slopes. These steep slopes already face the risk of failures, which is increased by the extensive cut slopes. The underlying litho unit is meta-argillite, which is highly jointed and mostly weathered. During the monsoons, the area receives intense rainfall, which infiltrates the weathered slope, leading to increase in unit mass. The steep slope cuts also add to the vulnerability of slope.

It is to be noted that most of the landslides occur within the lowly and moderately susceptible zones. These areas comprise of lowly and moderately dissected slopes, where modification of slope for cultivation and settlements are rampant. The slope gradient is also quite low in the area. Slopes are being removed for agricultural activities and to increase the land for farming. Irrespective of informing the people to reduce the gradient of the slope or bench the slope and provide plantation to stabilize it, they are reluctant.

Shifting of streams for increasing agricultural land also leads to slope failure. The farmers tend to shift the streams over a period of time either one bank to facilitate farming. As a result of this, the streams tend to cut the toe of the slope, causing landslides. This is observed to a great extent near Targod, Chauti, Manchikere, Kansur and Ajbail villages. Near Chauti village, it is observed that people remove the slope material for agricultural purposes, without providing any

reinforcement. Streams are also blocked to facilitate cultivation. People construct barrages over streams to impound water for use during the summer seasons. This leads to development of pressure upstream. This also caused massive landslides upstream as observed near Hitlahalli.

All areas where extensive cut slopes (ECS) are marked fall in high susceptibility zone. These places are vulnerable to slope failures due to removal of toe material which is being carried out without any support/ remedial measures and make these slopes unstable. ECS are mostly observed along the road cuts in the area. Most of these cuts are quite steep and no reinforcement or support has been given. Palaeo slides are observed adjoining cut slopes near Kansur, Bapeli, Ulvi, etc.

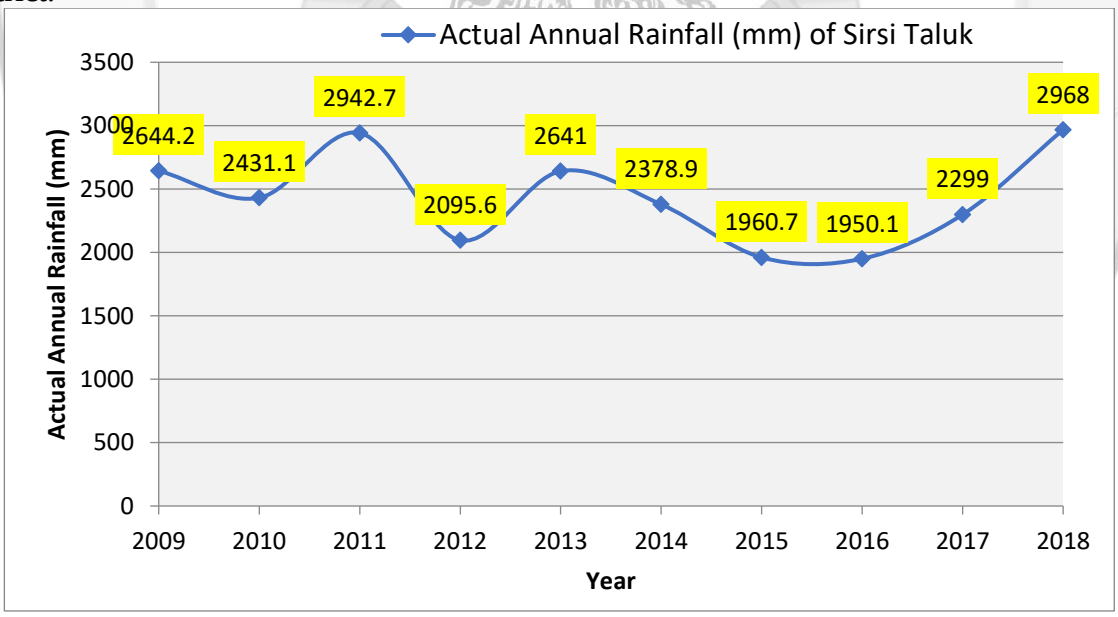
Chapter 6

Rainfall Analysis

. The Uttara Kannada district is located in the Western Ghats where rainfall remains from moderate to high during monsoon periods every year and that is why the district is occupying very lush green forests supported by a fertile soil cover. Moderate to high rainfall in every year allows the underlying rocks to weather deep by main chemical weathering processes in which a very thick and fertile soil cover is existing in hilly terrains of district. As per Uttara Kannada District Disaster Management Authority, the total expanse of the district is 10.27 lakh hectares out of which over 80% i.e. 8.28 lakh is forest land and about 10% i.e. 1.12 lakh hectare is being used for agriculture and horticulture. The average rainfall is 2887 mm with Siddapur recording highest rainfall at 5095 mm and Mundgod, the lowest (1281mm).

As per the analysis of rainfall data collected from the Deputy Commissioners Office, Karwar the average annual rainfall in last 9 years from 2010 to 2018 period in Sirsi, Siddapur and Yellapur taluks remained 2407mm, 3421mm and 2123mm respectively. The data shows that there is continuous rise in actual annual rainfall pattern in Sirsi, Siddapur and Yellapur taluks from year 2016.

Fig 6.1: Shows graphical representation of annual rainfall pattern in Siri taluk, Uttara Kannaad district.



However, during 2015-2016 years the actual annual rainfall goes down to minimum around 1500mm in last 9 years of record. Since it has been observed that landslide incidences occurred in study area are rainfall induced i.e., triggered by rainfall, the areas of Sirsi, Siddapur and Yellapur

taluks have witnessed maximum landslide incidences during last three years means from 2017 onwards. This impact is positively correlated with rise in rainfall pattern in the area. The increase rainfall pattern has triggered landslides on both natural slopes as well as on modified slopes under settlement or cultivation. The factors of rainfall increasing pattern, excessive runoff and turbulent stream flow in these taluks have created high vulnerability for erosion of slope & river bank material followed by channelized flow. This process have created high risk factor for settlement and cultivated places located in the close proximity of streams. Moreover, the increasing rainfall pattern in these taluks have surfaced or exposed the silenced process of natural drainage blockage and shrinkage by anthropogenic activities going on from decades. The increasing rainfall pattern in the area has given a way to slope with thick soil cover to gain more and more unit mass weight by addition of excess infiltrated rain water which lead to either slope failure along defined geological planes or development of surface cracks in thick overburden material by local material adjustments.

Fig 3.2: Shows graphical representation of annual rainfall pattern in Yellapur taluk, Uttara Kannad district.

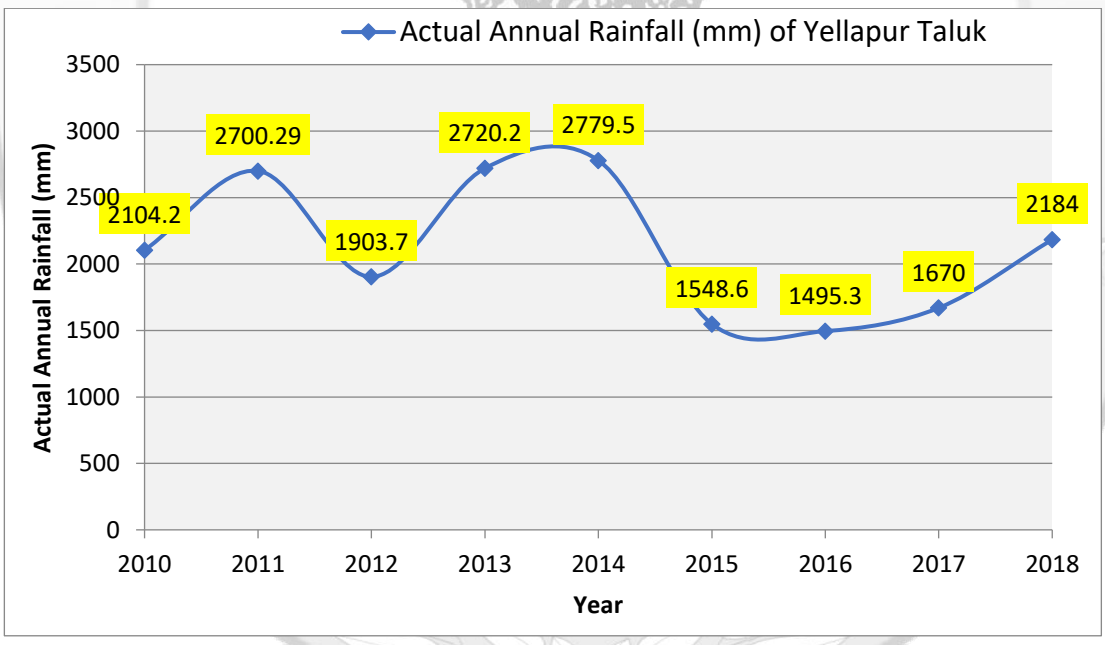
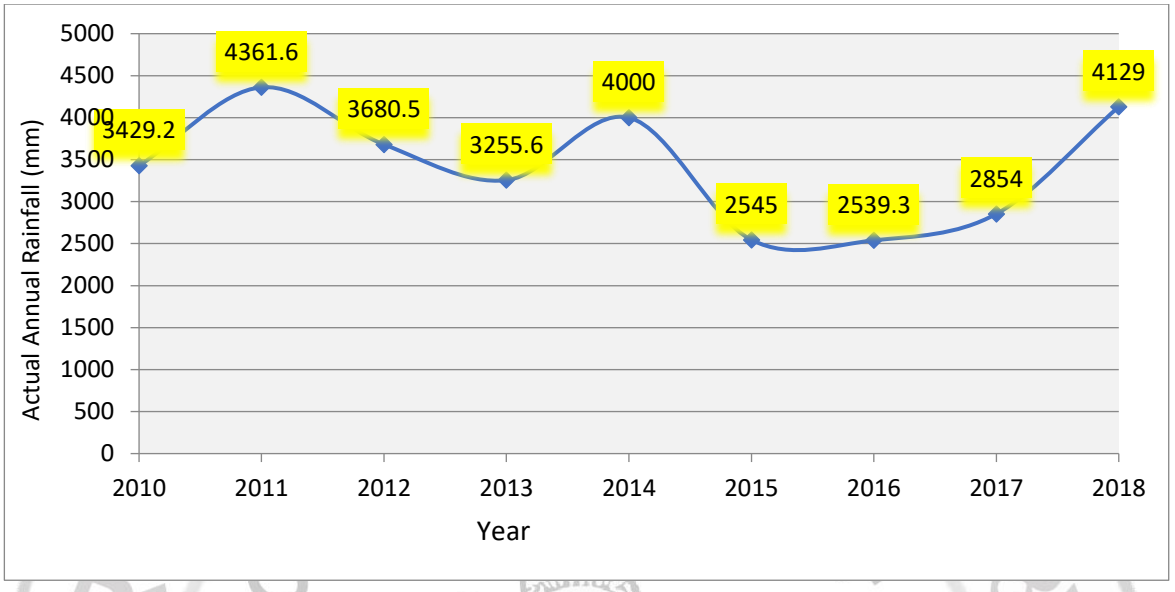


Figure-3.2: Shows graphical representation of annual rainfall pattern in Siddapur taluk, Uttara Kannad district.


Actual Annual Rainfall (mm)
5000
4500
4000
3500
3000
2500
2000
1500
1000
500
0
3429.2
4361.6
3680.5
3255.6
4000
2545
2539.3
2854
4129
2010
2011
2012
2013
2014
2015
2016
2017
2018
Year

Chapter 7

Summary and Conclusions

Macro scale Landslide Susceptibility Mapping was carried for 1577 sq.km in parts of toposheet no 48I/12, 48I/16, 48J/13 and J/14, around Sirsi, Ambikanagar and Dandeli villages in parts of Uttar Kannada and Shimoga districts of Karnataka out to generate a landslide susceptibility map using high resolution remote sensing data accompanied by field inputs. Along the Western Ghats as most of the landslides are cut slope failures, the thematic maps used were geomorphology, LULC, Slope forming material, regolith thickness and slope morphometry maps, which were prepared using Google Earth Multi temporal satellite imageries and CARTOSAT DEM data and validated in field.

The area forms a part of the Western Ghats and is marked by an undulating terrain. The northern part of the area, near Dandeli and Ambikanagara comprises a hilly terrain with thick forests. The terrain is rugged with innumerable low mounds and moderately dissected ridges. The valleys are narrow with small isolated cultivated patches. The southern part of the area near Sirsi is a more or less flat country, with few isolated hills, forming a plateau region. Extensive cultivation is practiced in the area, with settlements in the vicinity of the cultivated patches. The drainage pattern in the area is mainly dendritic to sub-dendritic. Along the ridge slopes trellis and sub parallel drainage pattern are observed. Tropical climate aided by incessant rainfall resulted in intense weathering and soil formation in the area. As the slopes are gentle, insitu soil formation supports lush vegetative growth as well. Transported soil is mainly restricted to the banks of river channels.

The area exposes lithounits of Archean- mainly Sargur Group, Peninsular Gneissic Complex and Dharwar Supergroup, Palaeoproterozoic Younger Intrusives and Laterites of Cenozoic age. The Dharwar Supergroup of rocks pertaining to Shimoga belt is exposed overlying the basement granite gneiss of Peninsular Gneissic Complex. Meta-ultramafite is the only lithounit representing the Sargur Group, occurring as a lensoidal body within the PGC. The Peninsular Gneissic Complex forms the basement and is represented by granitic gneiss. The Dharwar Supergroup is represented by rocks of the Chitradurga Group comprising Joldhal and Ranibennur Formations of the Shimoga Belt. The Joldhal Formation comprises limestone, manganese phyllite,argillite, banded magnetite quartzite and metabasalt and they represent shelf facies

sediments. The Joldhal Formation is overlain by a thick pile of greywacke-argillite sequence inter banded with Banded Iron Formations of Ranibennur Formation.

122 landslides were demarcated in field during the course of fieldwork. All the landslides were triggered by incessant rains from the southwest monsoons during the months of July to October, 2019. The slides were mostly along cut slopes meant for transportation corridors or for the purpose of agriculture. Most of the slides are earth and debris slides, with a very shallow slip plane and caused by shallow translational failure. The rock slides observed were mainly along highly jointed meta-argillite, where three joint sets were predominant.

There were two major causative factors for the slides- Toe erosion by streams flows along the base of the slope and the second being unscientific cut slopes for roads, settlements and cultivation. Stream shifting is also rampant in the area, where over a period of many years, streams are shifted to either bank to facilitate cultivation. Streams generally erode its bank, which is common. But during monsoon, the flow becomes very turbulent with increased volume of water accompanied by debris comprising rocks and plant remains of varying sizes. This tends to erode the banks to a great extent causing slope failure. Slopes are extensively modified for agricultural activities, human settlements and roads. These slope cuts are usually observed to be quite steep, some being near vertical and without any support or drainage maintenance. Moderate to thick vegetation in the form of large tress is observed on most of the slopes. When such slopes are cut without proper benching or providing support, the trees on the slope tend to add to the head load. These slopes are quite susceptible to failure during the monsoons. Moreover, the debris at the base of the slope after slope failure, tend to stabilize the slope with time this fallen material is removed for agricultural and construction purposes, thereby making the slope more vulnerable to failure. Extensive cut slopes are most susceptible to landslides and have been demarcated and noted in field. Landslides are observed in clusters in few locations near Kanchimane, Kansur, along the SH-93 from Sirsi to Yellapur, Chauti, Manchikere and along the roads to the KPCL Powerhouse in Ambikanagar. Remedial measures have been suggested at all locations.

The landslide susceptibility map was generated using the various thematic map divides the areas into zone based on the relative susceptibility. Only 2% of the area falls under the highly susceptible class which is mostly restricted to transportation corridors and areas adjoining extensive cut slopes. Almost 81% (1279 sq.km) of the area falls under the low landslide susceptibility zone. 17% of the area comes under the moderate susceptibility zone. When

compared with the number of landslides, most of the landslides are observed within the low susceptibility zone, indicating that landscape changes due to human interference is a major reason for slope failure. The area influenced by landslides is highest for the high susceptibility zone indicating that the high susceptible zone, even though limited in area is quite vulnerable.

Conclusions

- Almost 81% (1279 sq.km) of the area falls under the low landslide susceptibility zone. Only 2% of the area falls under the highly susceptible class which is mostly restricted to transportation corridors and areas adjoining extensive cut slopes. 17% of the area comes under the moderate susceptibility zone.
- Landslide susceptibility maps can be used for land use planning, urban planning and development and in assisting in slope management. The data can be utilized for generalized planning and assessment purposes for a given area. But for detailed design purposes, a more site-specific approach is required, where the local geological discontinuities and topographical variations are taken into consideration. The susceptibility map thus generated in valid only for the given geo-environmental factors and any spatial change in these parameters will lead to change in the outcome of the susceptibility map.
- All the landslides are induced or triggered by rainfall, and most of them occurred during the months from July to October, 2019.
- Most of the landslides have occurred in in-situ soil, where depth is between 0.5-5m. Shallow translational slides are more common, while deep translational slides are observed in few locations (Shivalli, Babankatte)
- It is observed that almost 66% of the landslides occur within 150m buffer zone of the drainage (79 landslides) indicating that the area adjacent to the streams is most vulnerable. 19% landslides occur within the zone between 150 and 300m. The farther we move away from the streams, the incidences of landslides become less. Streams are also being shifted over time and blocked to facilitate cultivation.
- The entire area can be distinctly divided into two terrains. The northern portion around Dandeli and Ambikanagar comprises dense forests along moderately dissected slope and isolated agricultural area. While the southern part of the study area comprises moderate vegetation along lowly to moderately dissected slopes, with settlements and adjoining

cultivated land. Agriculture is more predominant in the southern portion and it is noted that the lower order stream contain flowing water 3-4 months after the monsoons. Seasonal springs are quite common in the area and these acts as source of water for these rivers even during summer. On the other hand, though the region around Dandeli is occupied by thick vegetation, one to two months after the monsoon, the streams were observed to dry out. This could be due to extensive underwater seepage accompanied by interconnected discontinuities, as a result of which there isn't much water in the lower order stream.

Recommendations

- Remedial measures and mitigation techniques have been suggested at all locations to contain slides. They should be taken into consideration and implemented accordingly and monitored at the local level by governing bodies.
- Certain locations like Nalgona in Sirsi Taluk (toposheet no 48J/13) and Jajigudda (toposheet no 48J/9) comprise highly complex slides affecting a large area. Though remedial measures have been suggested, these areas need to be studied in detail to mitigate the slides as the settlements in the vicinity are at huge risk of further sliding.
- Different geomorphological and lithological evidences collected in present study area suggest that there would have been a period of local structural disturbance in the area in recent past which have brought new topographic and lithological features in place like development of fractured front with high slope gradient and dense drainage pattern from lowly dissected landform which was probably evolved since its inherent phase; development of isolated basins and subsequent deposition of quaternary sediments including gravel, sandy silt and clay layers within these isolated basins; appearance of moderate grade type of metamorphic rock (schist) on surface along fractured front whereas this rock type is not exposed anywhere in surrounding area; development of knick points along major rivers/streams; appearance of seasonal springs; exceptionally thick in-situ overburden cover on steep slopes. This may be taken up for further studies at regional level.

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Locality Index

S. No	Location	Lattitude	Longitude
1	Alnavar	15° 25′ 48″ N	74° 43′ 48″ E
2	Ambikanagar	15° 7′ 27.48″ N	74° 39′ 32.4″ E
3	Aurli	15° 6' 36.647" N	74° 31' 7.190" E
4	Bangalore	12° 59’ 00”N	77° 35’ 00”
5	Bhairumbe	14° 41' 55.719" N	74° 49' 23.268" E
6	Bisalkoppa	14° 32′ 34.85″ N	74° 50′ 10.58″ E
7	Dandeli	15° 16′ 1.2″ N	74° 37′ 1.2″ E
8	Dantkal	14° 30' 41.878" N	74° 48' 42.494" E
9	Dharwad	15° 27′ 30″ N	75° 00′ 30″ E
10	Ekkambi	14° 41' 49.894" N	74° 55' 16.147" E
11	Ganeshpal	14° 47' 2.730" N	74° 45' 17.372" E
12	Gunjavati	14° 59′ 32.13″ N	74° 55′ 38.78″ E
13	Haveri	14° 47′ 38″ N	75° 24′ 14″ E
14	Hubli	15° 21′ 0.78″ N	75° 8′ 15.45″ E
15	Hunshettykoppa	14° 58' 55.864" N	74° 49' 2.923" E
16	Kannigeri	15° 1' 3.917" N	74° 43' 17.447" E
17	Kansur	14° 30' 49.074" N	74° 50' 35.566" E
18	Kolagibis	14° 33' 12.641" N	74° 45' 37.467" E
19	Kumta	14° 25′ 12″ N	74° 24′ 00″ E
20	Londa	15° 27′ 00″ N	74° 29′ 40″ E
21	Manchikere	14° 51′ 36.05″ N	74° 49′ 0.02″ E
22	Melagaon	14° 53′ 43.65″ N	74° 45′ 46.53 E
23	Siddapur	14° 20′ 49.2″ N	74° 53′ 38.4″ E
24	Sirsi	14° 37' 7.899" N	74° 49' 59.554" E
25	Sonda	14° 44′ 4.86″ N	74° 48′ 56.82″ E
26	Sonda Cross	14° 43' 53.245" N	74° 49' 17.101" E
27	Suremane	14° 51' 52.259" N	74° 46' 18.927" E
28	Suremane	14° 51′ 50.74″ N	74° 46′ 13.61″ E
29	Talguppa	14° 12′ 54″ N	74° 54′ 43.2″ E
30	Taragodu	14° 39' 48.393" N	74° 50' 4.386" E
31	Ulvi	15° 0' 10.465" N	74° 30' 40.208" E
32	Umachgi	14° 48' 38.327" N	74° 50' 2.451" E
33	Yellapur	14° 58′ 12″ N	74° 43′ 12″ E

FIVE POINT PROFORMA

Title of the report	:	Macro-Scale (1:50,000) Landslide Susceptibility Mapping in parts of Toposheet Nos. 48I/12, 48I/16, 48J/13 And 48J/14, Uttara Kannada &Shimoga Districts, Karnataka
Name(s) of the author(s)	:	K. V. Neena Vaman, Sr. Geologist Aijaz Ahmad Bhat, Sr. Geologist
Background of the investigation at whose instance or with what particular objective in view the investigation was undertaken	:	(i) Preparation of landslide inventory database using high resolution remote sensing data, archival information and field inputs (ii) Preparation of spatial database for geo-factors of landslides on 1:50,000 scale (iii) Categorization of hill slope in terms of landslide susceptibility using multi-class index overlay method in GIS platform.
Whether the item of investigation was included in the approved programme for the year concerned, if so,particulars,such as item No. and page reference.	:	Yes, item was included in approved Programme of GSI Code No: **M4LSSM/NC/SR/SU-KG/2019/27979**
Date of commencement of the investigation with month and year and exact number of days spent by the officer(s) in the field in connection with the investigation.	:	20.09.2020 1. K. V. Neena Vaman (85 days) 2. Aijaz Ahmad Bhat. (88 days)
Brief comments by Director/Supervisory officer on conclusion and recommendation by the author(s) with suggestion for implementing the same.	:	
Please state specifically how the results of the investigation were achieved compared with objective for which it was undertaken	:	Landslide susceptibility analysis was carried out for an area of 1577 sq.km, with the preparation of a database of the various landslides observed in field on the parametric datasheet. The various thematic maps prepared prior to field initiation, were validated in field and used in the generation of a landside susceptibility map. The map thus

		generated classified the area into zones- high, moderate and low , based on the relative susceptibility
	:	Sd/- Name: K. V. Neena Vaman, Designation: Geologist Project/Division: STM Operations/Region: Karnataka & Goa
Place	:	Bangalore
Date	:	30.06.2016

SYNOPSIS OF WORK DONE

1.Title of the report	Macro-Scale (1:50,000) Landslide Susceptibility Mapping in parts of Toposheet Nos. 48I/12, 48I/16, 48J/13 And 48J/14, Uttara Kannada &Shimoga Districts, Karnataka
2. Code No	M4LSSM/NC/SR/SU-KG/2019/27979
3. Field season	2019-20
4.Date of commencement	20.09.2020
5.Date of completion	15.03.2020
6.Officers associated with the investigation and number of field days in the field	K. V. Neena Vaman, Geologist (85days) Aijaz Ahmad Bhat, Sr. Geologist (88 days)

7.Quantum of work done

Nature of Work	Target FS 2019-20 (Sq.km)	Achievement FS 2019-20 (Sq.km)
1. Pre-field map preparation		
i)Thematic maps (in GIS on scale 1:50000)	1577	1577
a. Slope Forming Material map	1577	1577
b. Geomorphology & Lineament map	1577	1577
c. Slope Morphometry (slope, aspect & curvature) map	1577	1577
d. Land use - Land cover map	1577	1577
e. Drainage map	1577	1577
f. Regolith thickness map	1577	1577
ii) Landslide inventory map	1577	1577
2. Field Studies		
i) Field checking of all thematic maps	1577	1577
ii)Field checking and collection of landslide inventory attributes (42 point geo - parametric sheet)	1577	1577
3. Post field studies and modelling		
i)Updation of thematic and landslide inventory maps	1577	1577
ii)Landslide susceptibility modelling and finalization of	1577	1577

	landslide susceptibility map in GIS		
	4. Collection of Rainfall data	1577 (Rainfall data collected from Uttara Kannada and Shimoga Districts)	
8.Analysis carried out quantitatively	NA		
9.Expenditures in Rs.	POL	NA	
	Wages	Rs. 46154.42/-	
	OC	Rs. 68674/-	
	Outsourcing vehicle	Rs. 239863/-	
	Total	Rs. 3, 54, 691.54/-	
10.Other information, if any	Nil		

Aijaz Ahmad Bhat,
(Sr. Geologist)

K. V. Neena Vaman
(Sr. Geologist)

Shri. K. V. Maruthi
Director

INFORMATION SHEET FOR BIBLIOGRAPHY

1.Title of the report	:	Macro-Scale (1:50,000) Landslide Susceptibility Mapping in parts of Toposheet Nos. 48I/12, 48I/16, 48J/13 And 48J/14, Uttara Kannada &Shimoga Districts, Karnataka
2.Authors Name	:	K. V. Neena Vaman, Geologist (85days) Aijaz Ahmad Bhat, Sr. Geologist (88 days)
3. Item No/code	:	M4LSSM/NC/SR/SU-KG/2019/27979
4.Field season	:	2019-20
5.Type of document	:	Final report
6. Identification of confidentiality	:	Limited circulation report
7.Name of the region/division/project	:	Southern Region SU: Karnataka & Goa Project: NLSM-27979
8.Name of the beneficiary	:	
9.Date of Publication	:	September 2020
10.Abstract	:	Appended as separate sheet
11. Mapping reference	:	Toposheet No. 48I/12, 48I/16, 48J/13 And 48J/14
12.Name of the District	:	Uttara Kannada &Shimoga Districts, Karnataka

Geological Survey of India

Certificate of Quality of the Report

Project/Division: NLSM **FSP No.:** **M4LSSM/NC/SR/SU-KG/2019/27979** **Mission IV**

Title of the report: Macro-Scale (1:50,000) Landslide Susceptibility Mapping in parts of Toposheet Nos. 48I/12, 48I/16, 48J/13 And 48J/14, Uttara Kannada &Shimoga Districts, Karnataka

Part-A

This is to certify that the following officer (s) have carried out the above mentioned FSP, and are responsible for collection of field data , carrying out the required laboratory analysis, compilation and synthesis of field data, coalition of the data and writing of the report as per the approved guidelines. The duration of the field stay of each officer(s) is as against his/her name.

Name(s)/ Designation of the Field Officer	Total field stay during the FSP(no. of days)	Signature with date
1. K. V. Neena Vaman, Senior Geologist(120505)	85 days	
2. Aijaz Ahmad Bhat, Senior Geologist	88 days	

Part-B

This is to certify that drilling has been carried out and completed as per the table given below:

Drilling Unit No.	Date of commencement of drilling	Date of completion of drilling	Name and Signature of the Director Drilling
1. -NA-	-NA-	-NA-	-NA-
2. -NA-	-NA-	-NA-	-NA-

Part-C

This is to certify that geophysical component of the item has been carried out as per the table given below:

Name(s)/Designation of Geophysist	Date of commencement of work	Date of completion of work	Signature with date of the Geophysist'
1. -NA-	-NA-	-NA-	-NA-
2. -NA-	-NA-	-NA-	-NA-
Name and Signature with date of the Director(Geophysist)			

Part-D

This is to certify that the chemical analysis of the geological samples has been carried out as per the table given below:

Analysis	Name of Director –in-charge of the laboratory	Dates of receipt of samples from the field officer/party	Date of providing complete analytical results to the field officer	Signature with date of the Director chemistry
NA	NA	NA	NA	NA

Part-E

This is to certify that the below mentioned Supervisory Officer(s) have supervised the above item and have provided guidance to the Field Officer(s). The number of inspection visits and total duration of visits is as per the below table. It is also certified that thorough scrutiny of the report for maintaining the scientific contents and its Quality has been overseen.

Name(s)/Designation of the supervisory Officer	No. of inspection visits made to the field area	Total no. of days spent on inspection visit	Signature with date
Shri. K. V. Maruthi	3	10	

Part-F

This is to certify that the report has been thoroughly scrutinized at the Regional Mission Head level. The scientific contents and the Quality of the report are certified. The report has been peer reviewed and the needful corrections have been attended to

Name(s)/Designation of the Regional Mission Head	Signature with date

Part-G

This is to certify that the above report has been scrutinized at various levels and has also been peer reviewed. On being satisfied regarding the scientific contents and the Quality of the report, the undersigned has accorded approval for its circulation.

Name(s)/Designation of the Regional HOD	Signature with date

Geological Survey of India
Data sheet on report movement in connection with its scrutiny

Project Division: NESMLNGG & Landslide Division	FSP Code : MH/SSNT/NG/SR/SL-8(G)/2019-27979	Mission: - IV

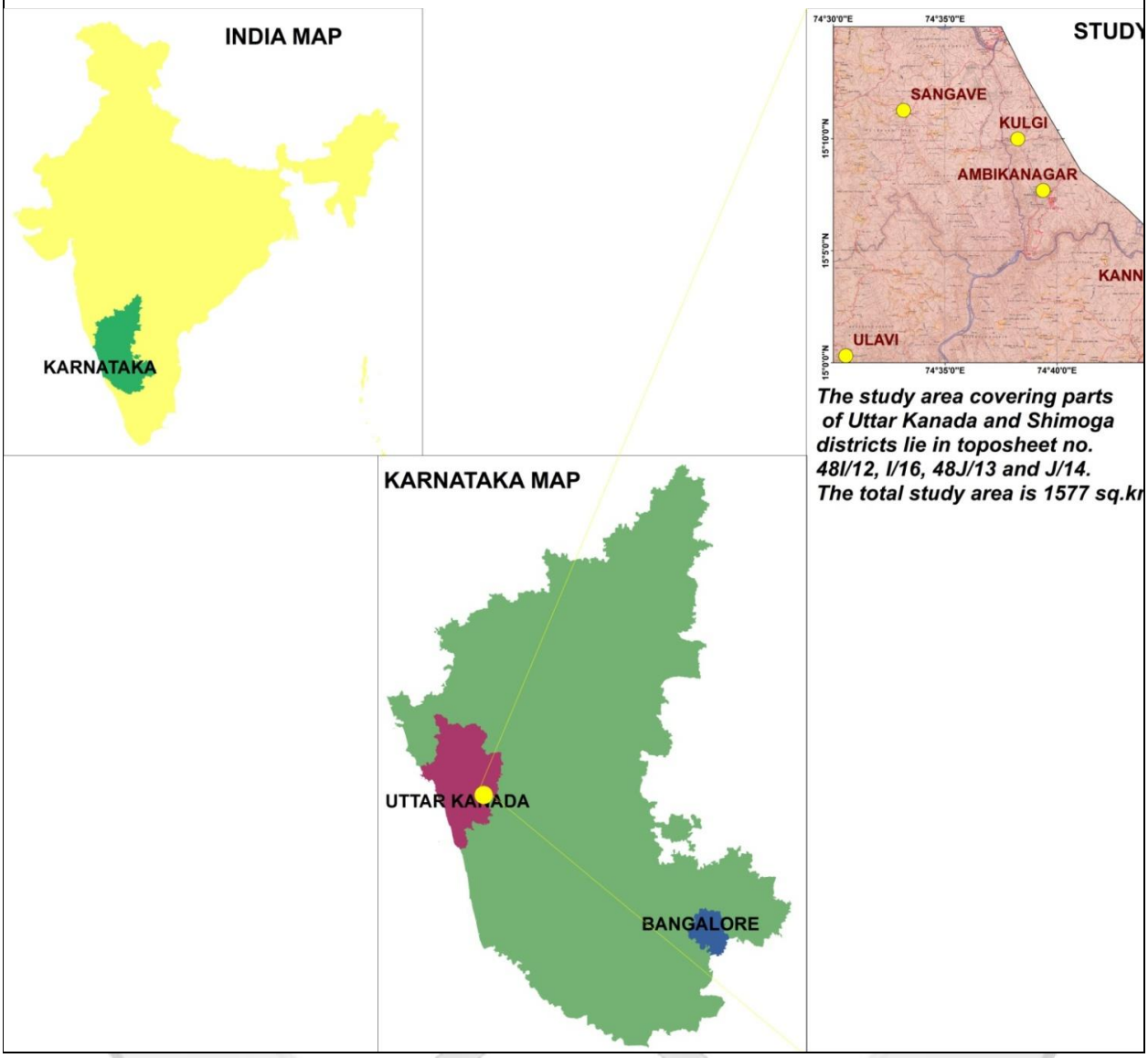
Title of the Project : Micro-Scale (1:50,000) Landslide Susceptibility Mapping in parts of Toposheet Nos. 48J/12, 48J/16, 48J/15 And 48J/14, Uttara Kannada & Shimoga Districts, Karnataka

Name of author(s) 1. K. V. Neena Vaman, Sr. Geologist 2. Aijaz Ahmad Bhat, Sr. Geologist	Date of submission of report to the Supervisory Officer: 30/06/2020 Signature of the author: 27/06/2020 (Signature of the senior most author)
Name of Supervisory Officer K.V. MARUTHI DIRECTOR	Date of receipt of report: 30/06/2020 Date of completion of scrutiny: 17/07/2020 Date of handing over report to the author after scrutiny: 17/07/2020 Signature: M Maruthi. K.V
Name of author(s) to whom the report has been handed over by the Supervisory Officer K.V NEENA VAMAN (Sr Geologist)	Date of receipt after scrutiny: 17/07/2020 Signature: 17/07/2020 Date of resubmission: 30/07/2020 Signature: 30/7/2020
Supervisory Officer K.V. MARUTHI DIRECTOR	Date of receipt 2nd draft after modification: 30/07/2020 Date of handing over report to the RMH: 30/07/2020 Signature: M Maruthi. K.V.
Regional Head S.K. Tripathi DDG, RMH-IV	Date of receipt / report Date of handing over the report after peer review to the Project Director S.K. Tripathi

2

(Through internal peer review committee)	Signature
Name of Supervisory Officer K.V. MARUTHI	Date of receipt of report from the RMH after peer review 25/11/2020 Date of handing over to author(s) 25/11/2020 Signature K.V.
Name of author(s) K.V NEENA VAMAN	Date of receipt of report from Supervisory Officer 25/11/2020 Date of handing over report after Modification to Supervisory Officer 26/11/2020 Signature 26/11/2020
Name Supervisory Officer K.V. MARUTHI	Date of receipt of report after modification from author (s) 26/11/2020 Date of handing over report to RMH 27/11/2020 Signature K.V.
Name of Regional Mission Head (RMH) S.K. Tripathi DDG, RMH-IV	Date of receipt after modification from the Project Director Date of handing over report to the HoD of the Region for approval Signature Sk. Tripathi
Name of the HOD of the Region एस.के. त्रिपाठी/S.K. TRIPATHI उप महा निदेशक/Dy. Director General, HOD क्षेत्रीय मिशन प्रमुख/Regional Mission Head IV भारतीय भूवैज्ञानिक सर्वेक्षण/Geological Survey of India दक्षिणी क्षेत्र, हैदराबाद/Southern Region, Hyderabad.	Date of receipt of report for approval Date of approval Date of sending back report to the Project Director Signature of the HoD Sk. Tripathi
Name of the Project Director	Date of receipt of report after approval of HOD Date of circulation of report Signature

Plate 1 Map showing study area in parts of SOI toposheets **48I/12, 48I/16, 48J/13 and 48J/14**



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Plate 2 Geological Map of parts of SOI toposheets **48I/12, 48I/16, 48J/13 and 48J/14**

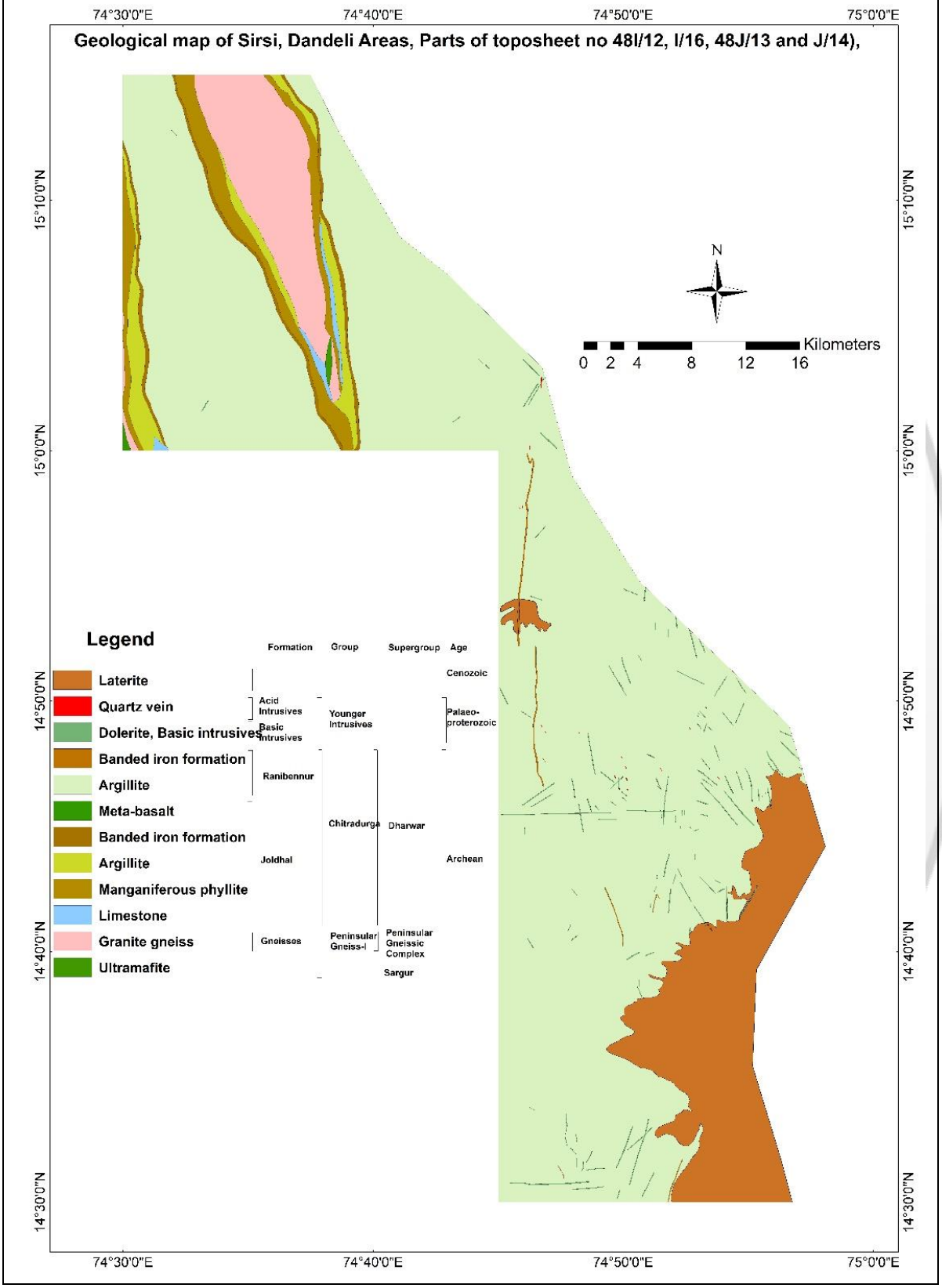


Plate 3 Landslide Inventory Map of parts of SOI toposheets **48I/12, 48I/16, 48J/13 and 48J/14**

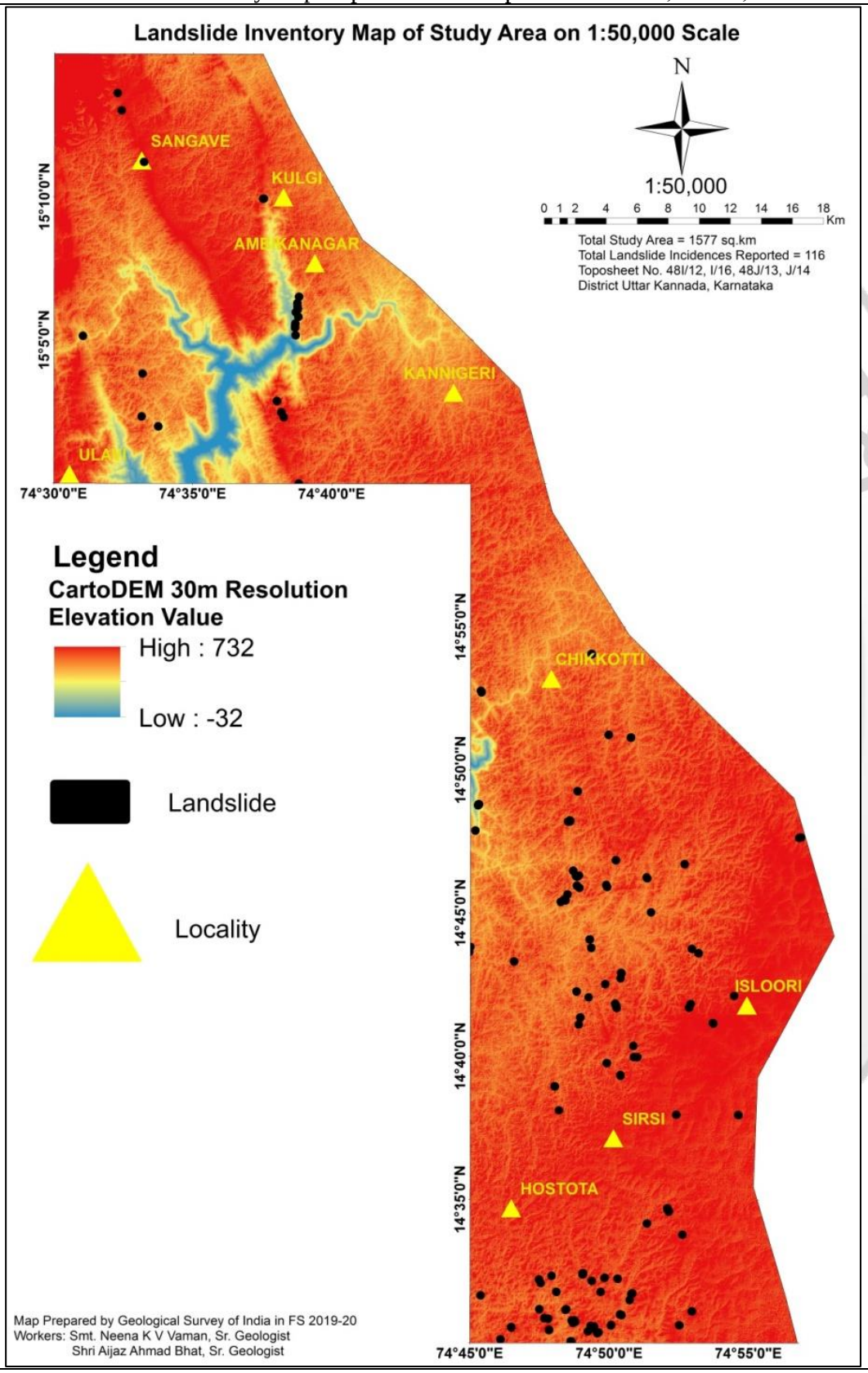


Plate 4 Slope Gradient Map of parts of SOI toposheets **48I/12, 48I/16, 48J/13 and 48J/14**

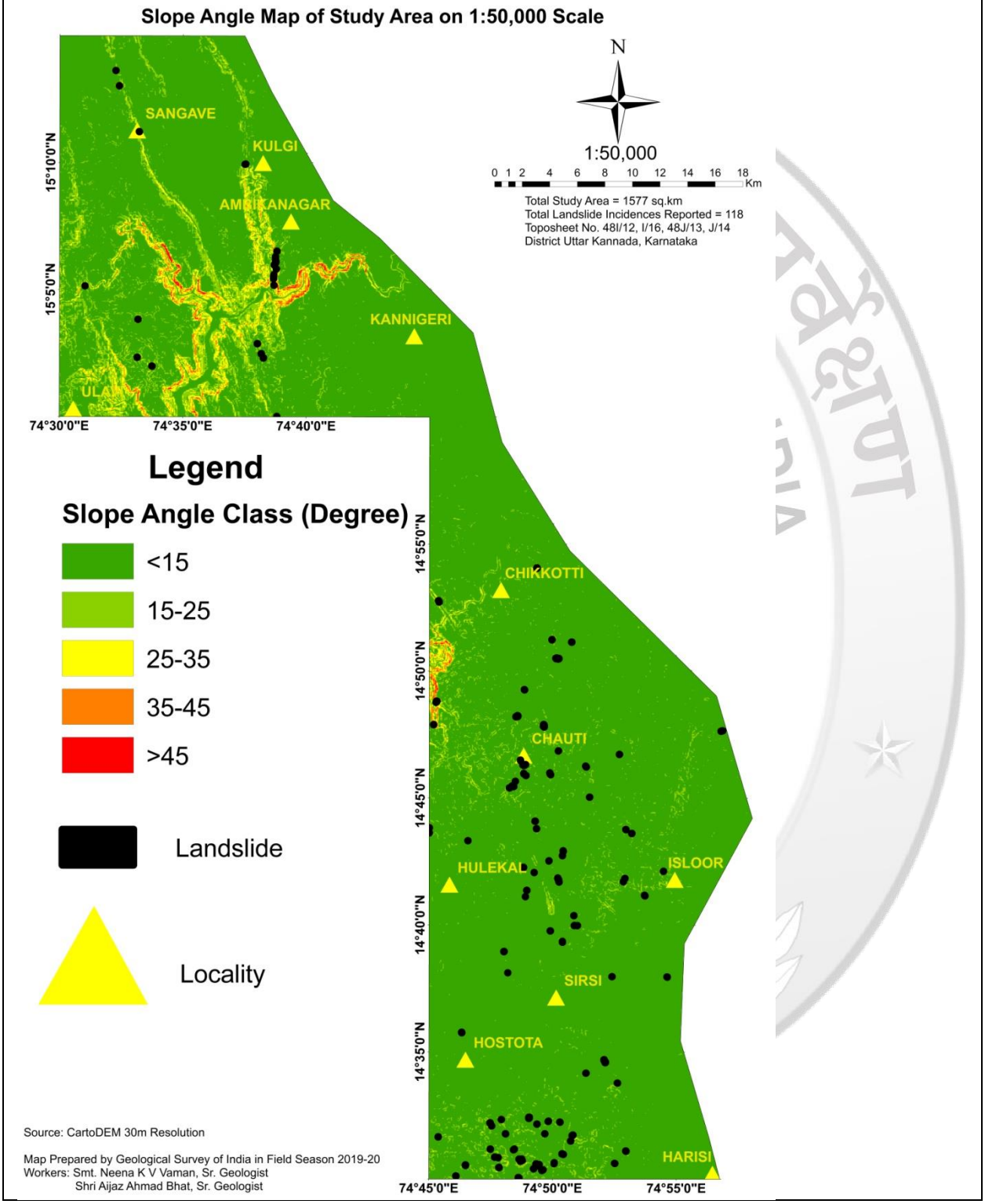


Plate 5 Slope Curvature Map of parts of SOI toposheets **48I/12, 48I/16, 48J/13 and 48J/14**

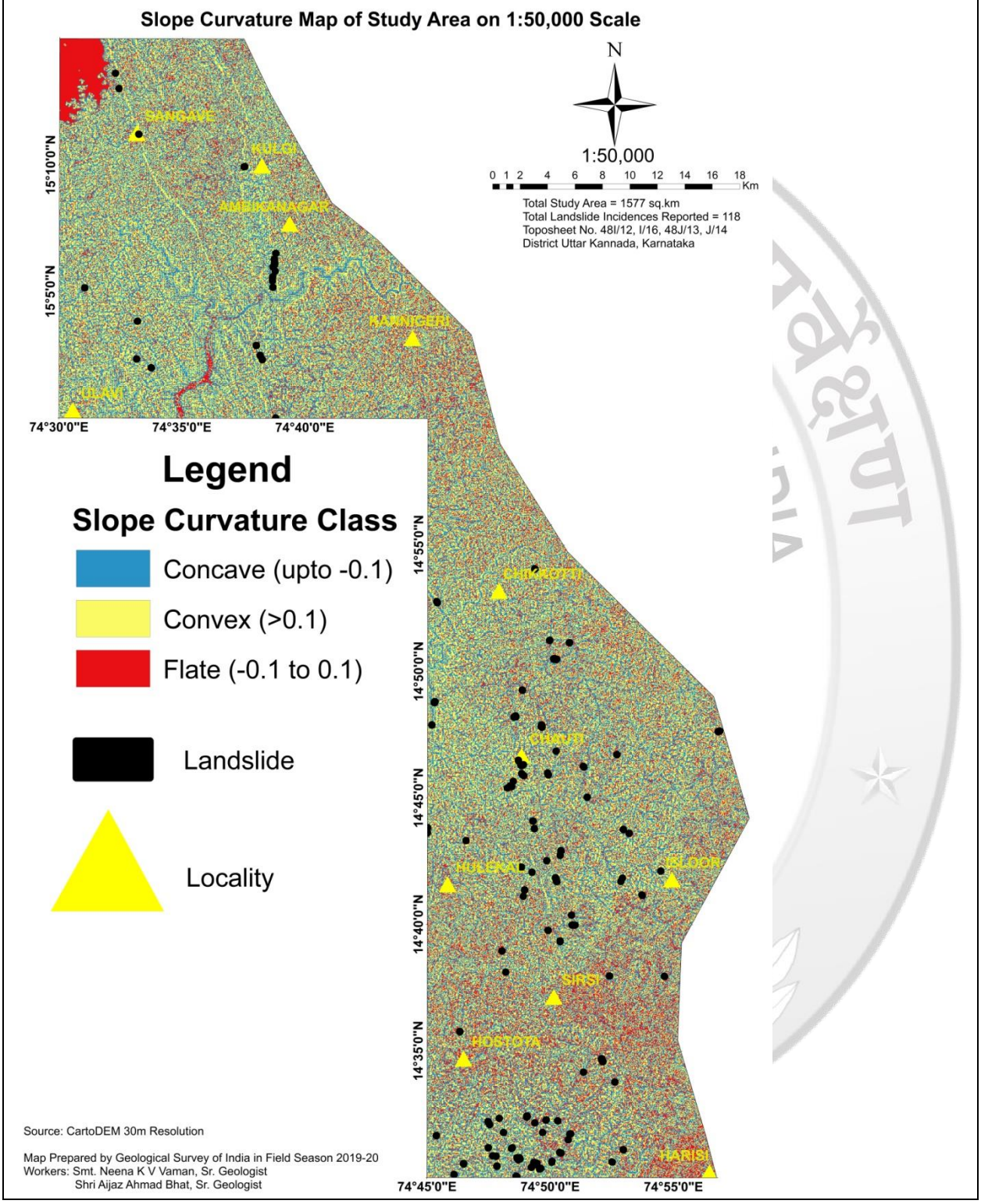


Plate 6 Slope Aspect Map of parts of SOI toposheets **48I/12, 48I/16, 48J/13 and 48J/14**

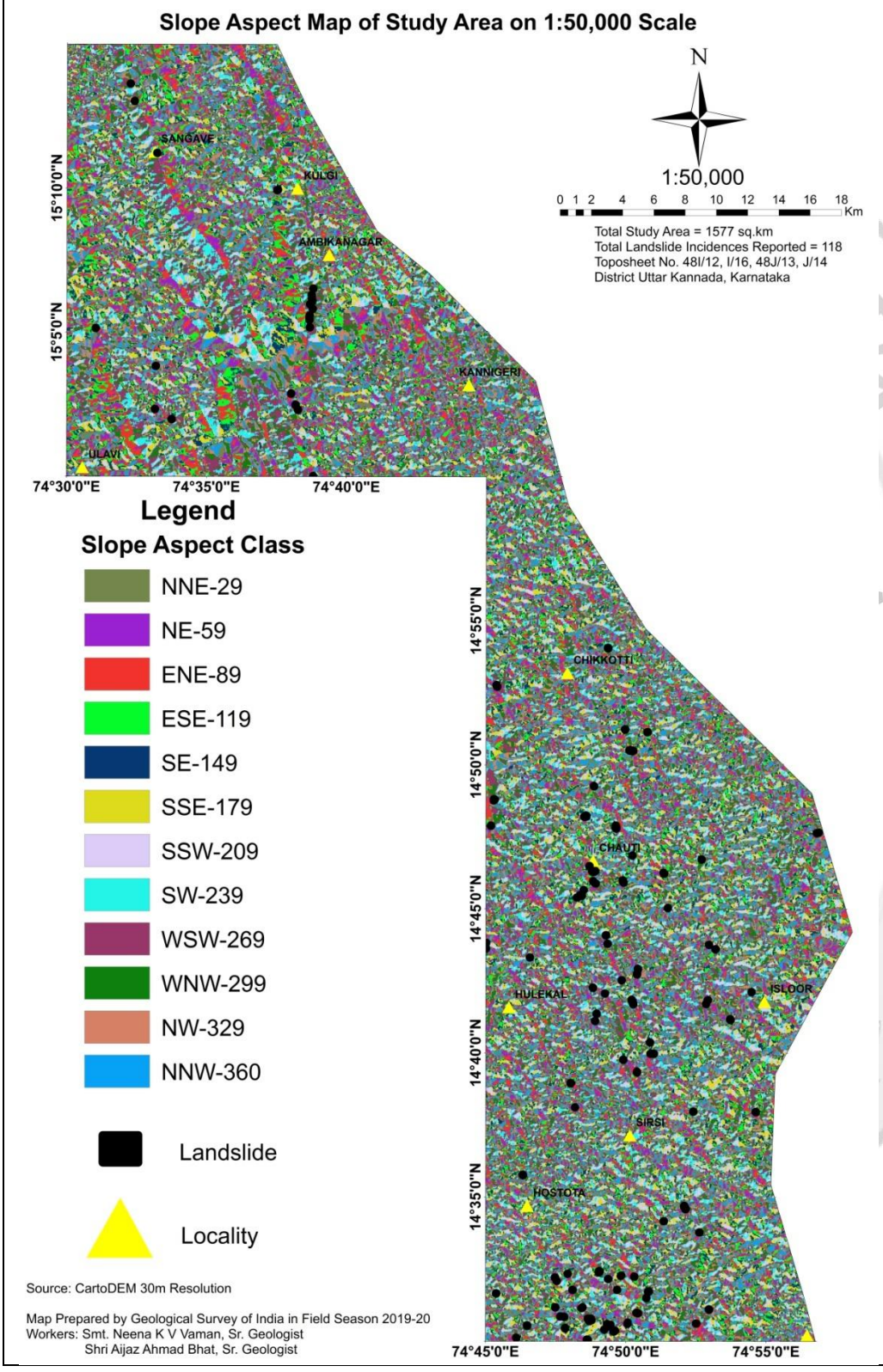


Plate 7 LULC Map of parts of SOI toposheets **48I/12, 48I/16, 48J/13 and 48J/14**

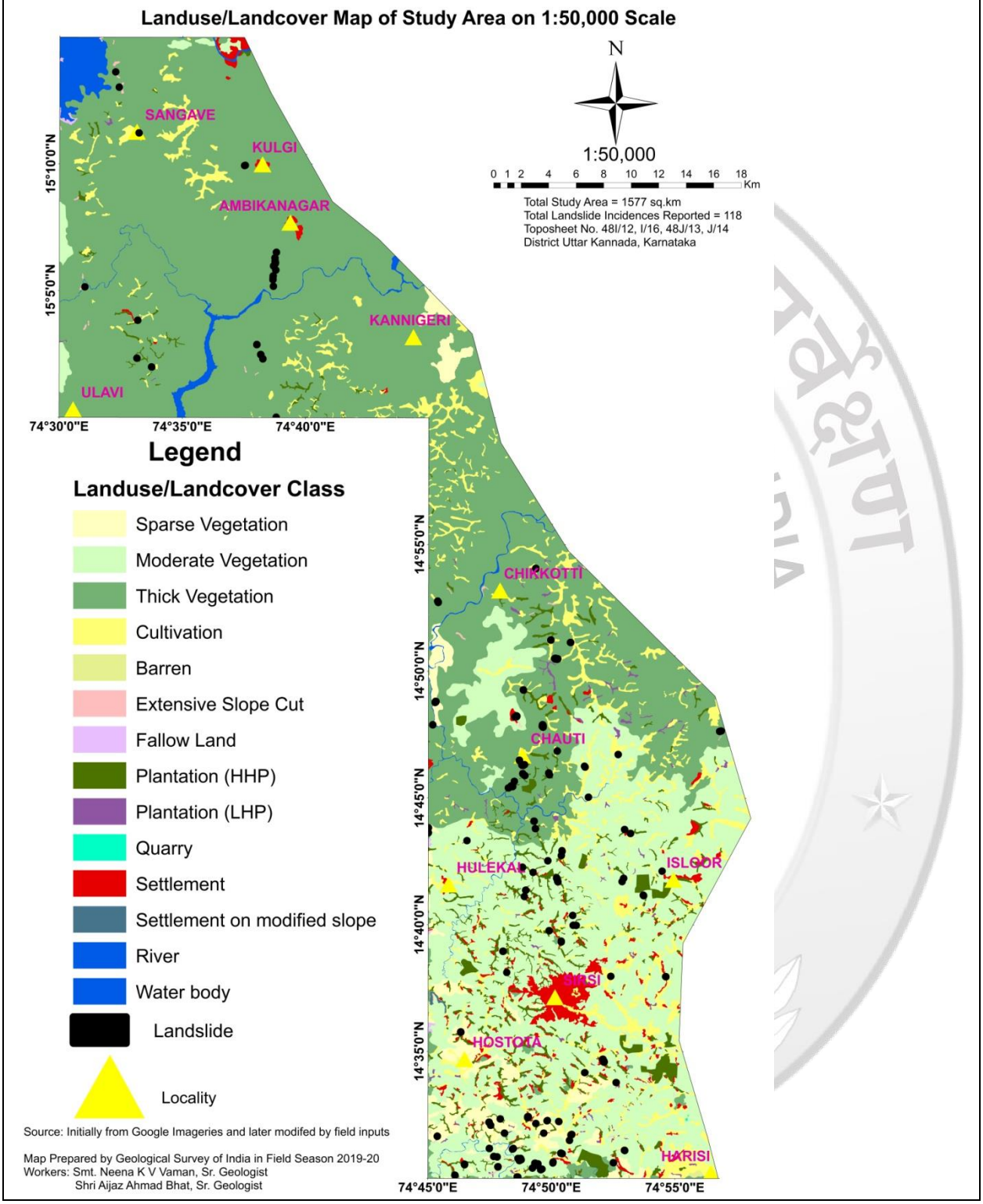


Plate 8 Geomorphology Map of parts of SOI toposheets 48I/12, 48I/16, 48J/13 and 48J/14

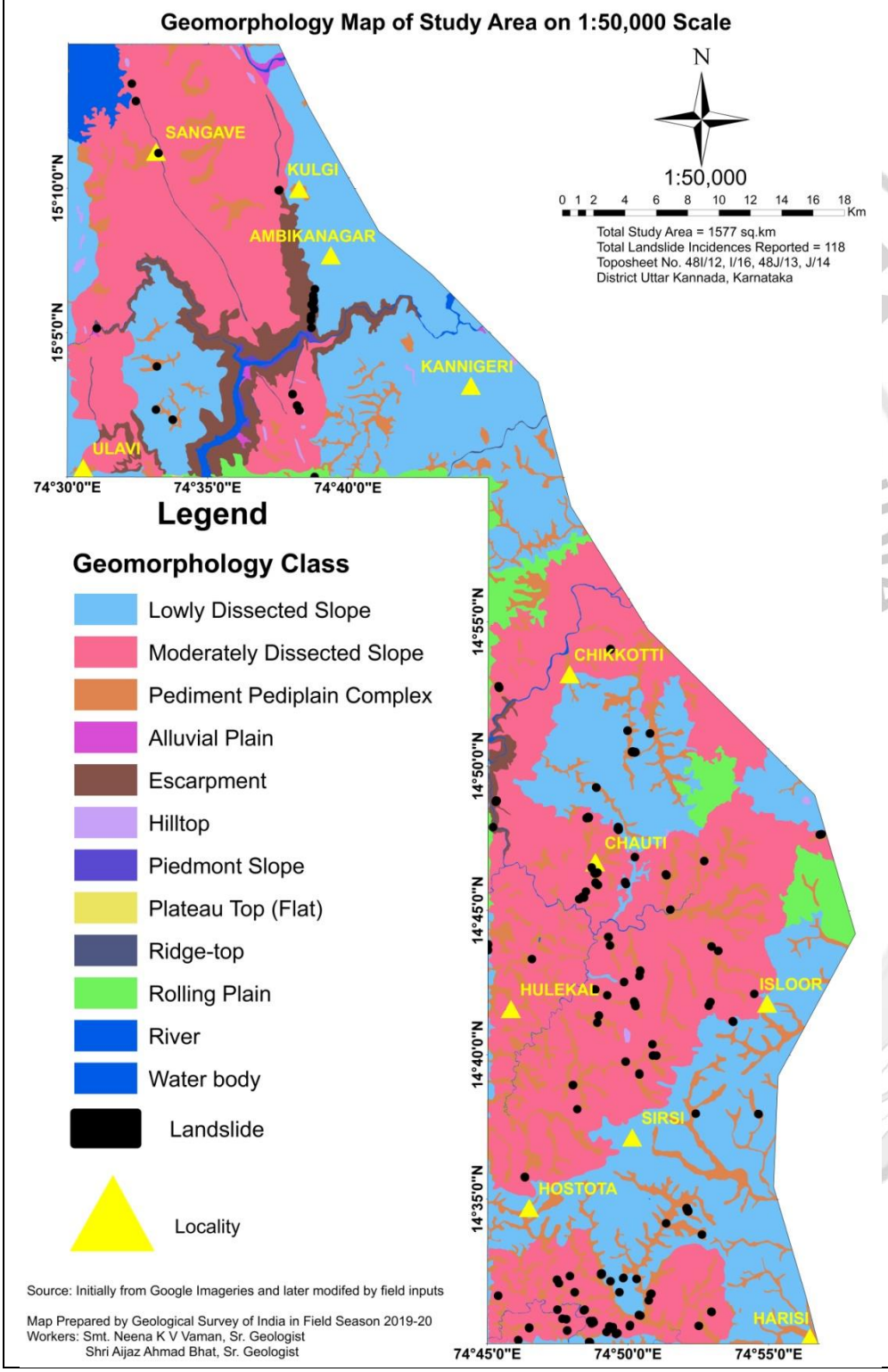


Plate 9 Slope Forming Material Map of parts of SOI toposheets **48I/12, 48I/16, 48J/13 and 48J/14**

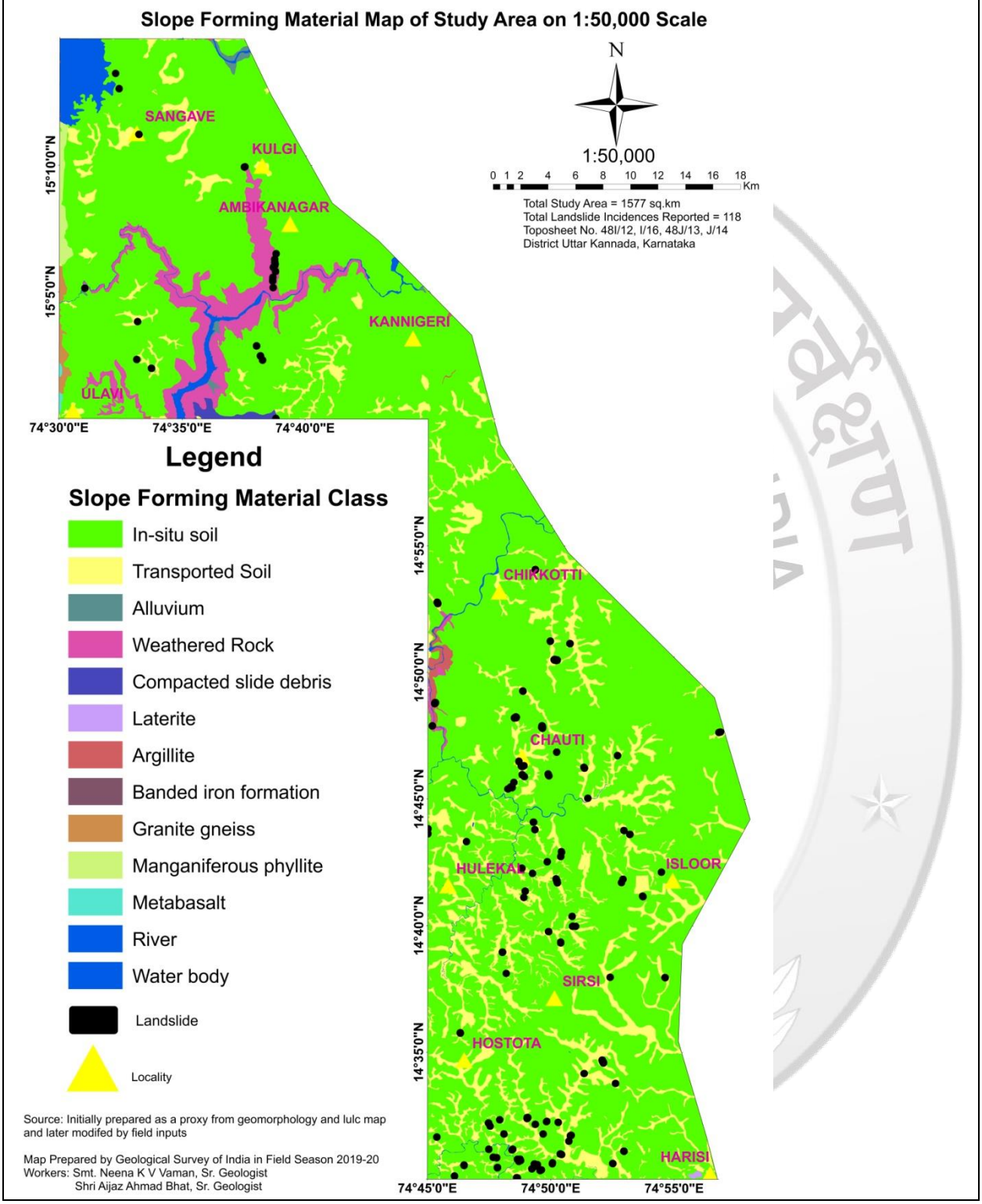


Plate 10 Regolith Thickness Map of parts of SOI toposheets **48I/12, 48I/16, 48J/13 and 48J/14**

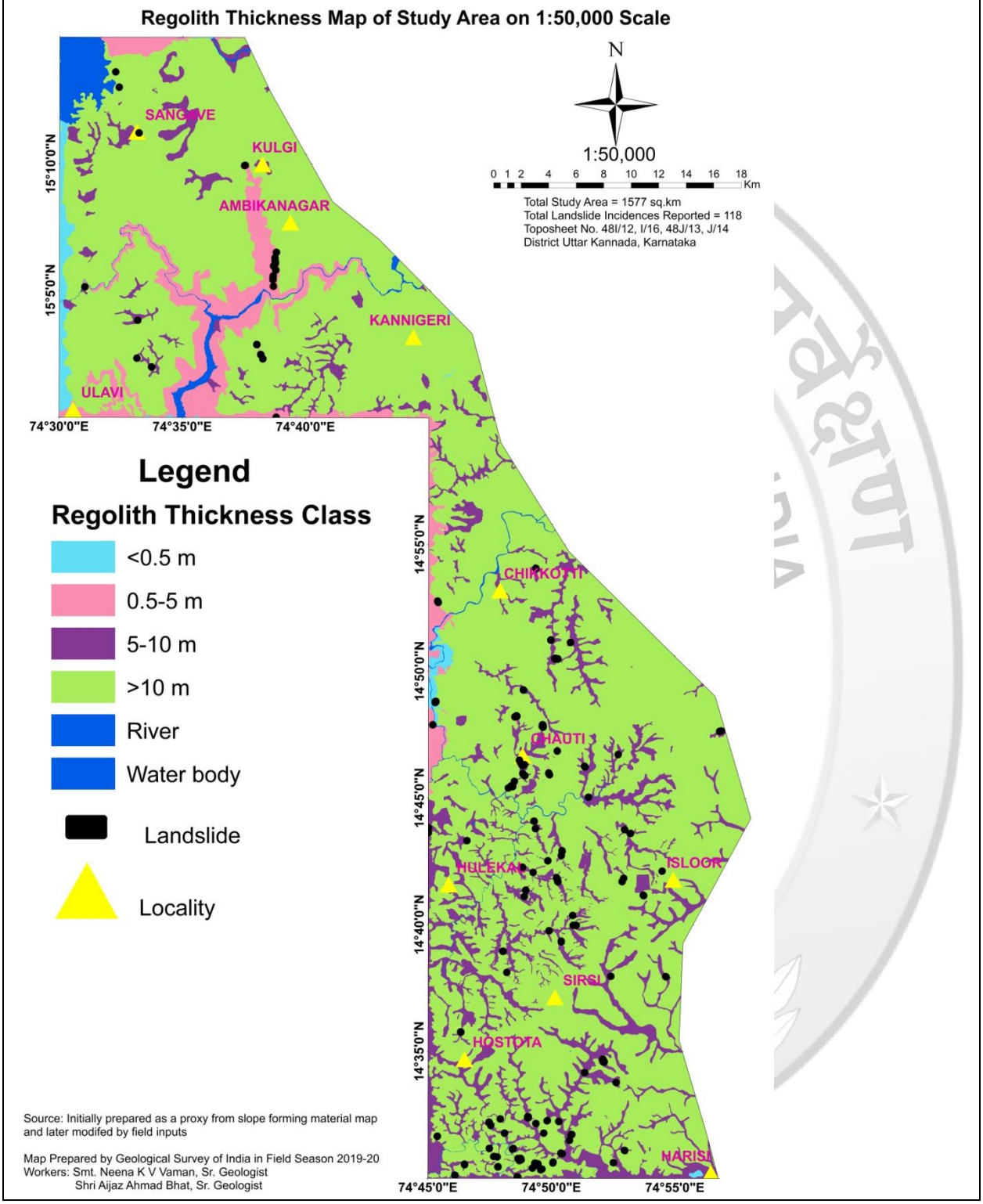


Plate 11 Drainage Map of parts of SOI toposheets **48I/12, 48I/16, 48J/13 and 48J/14**

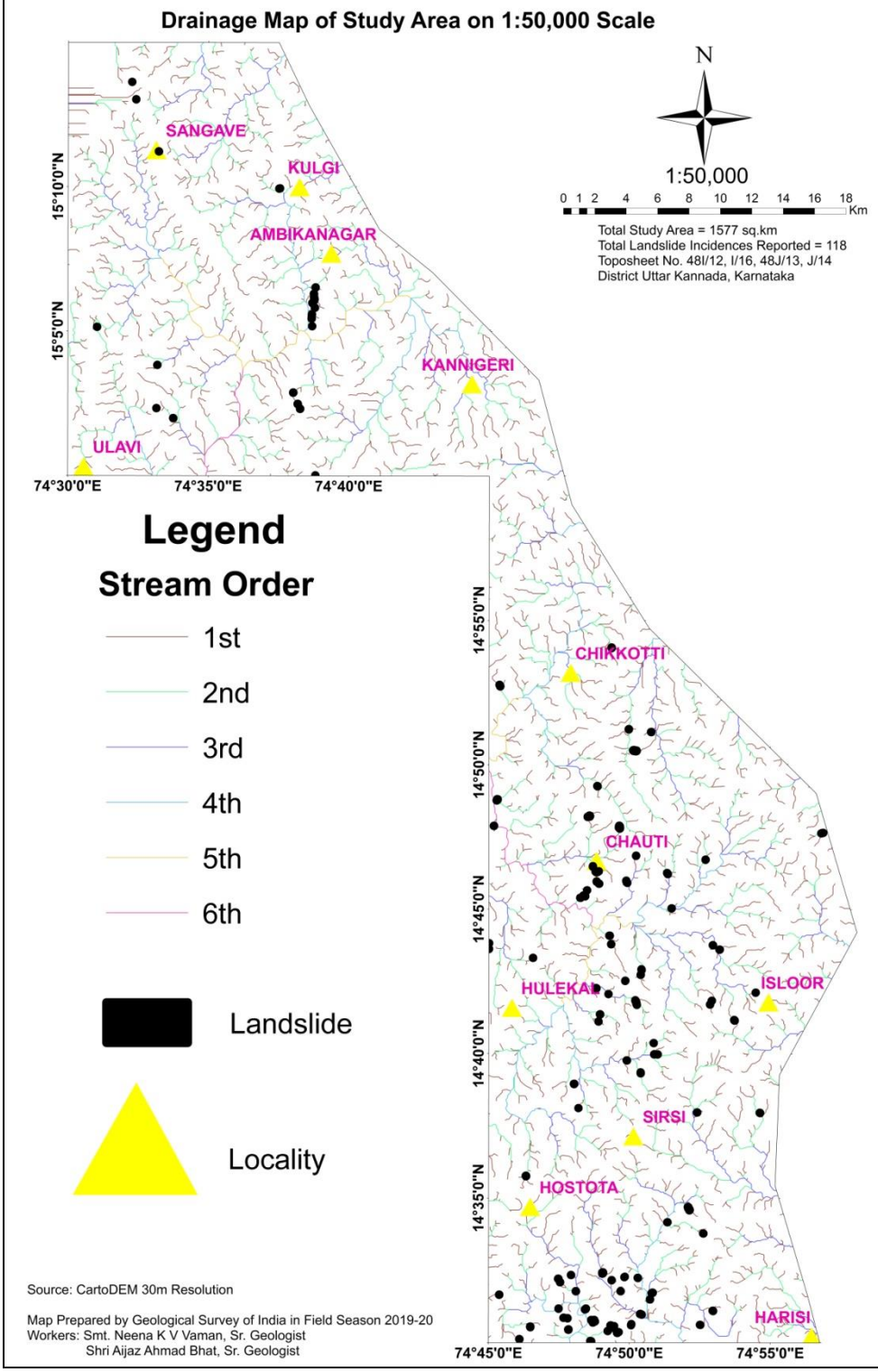
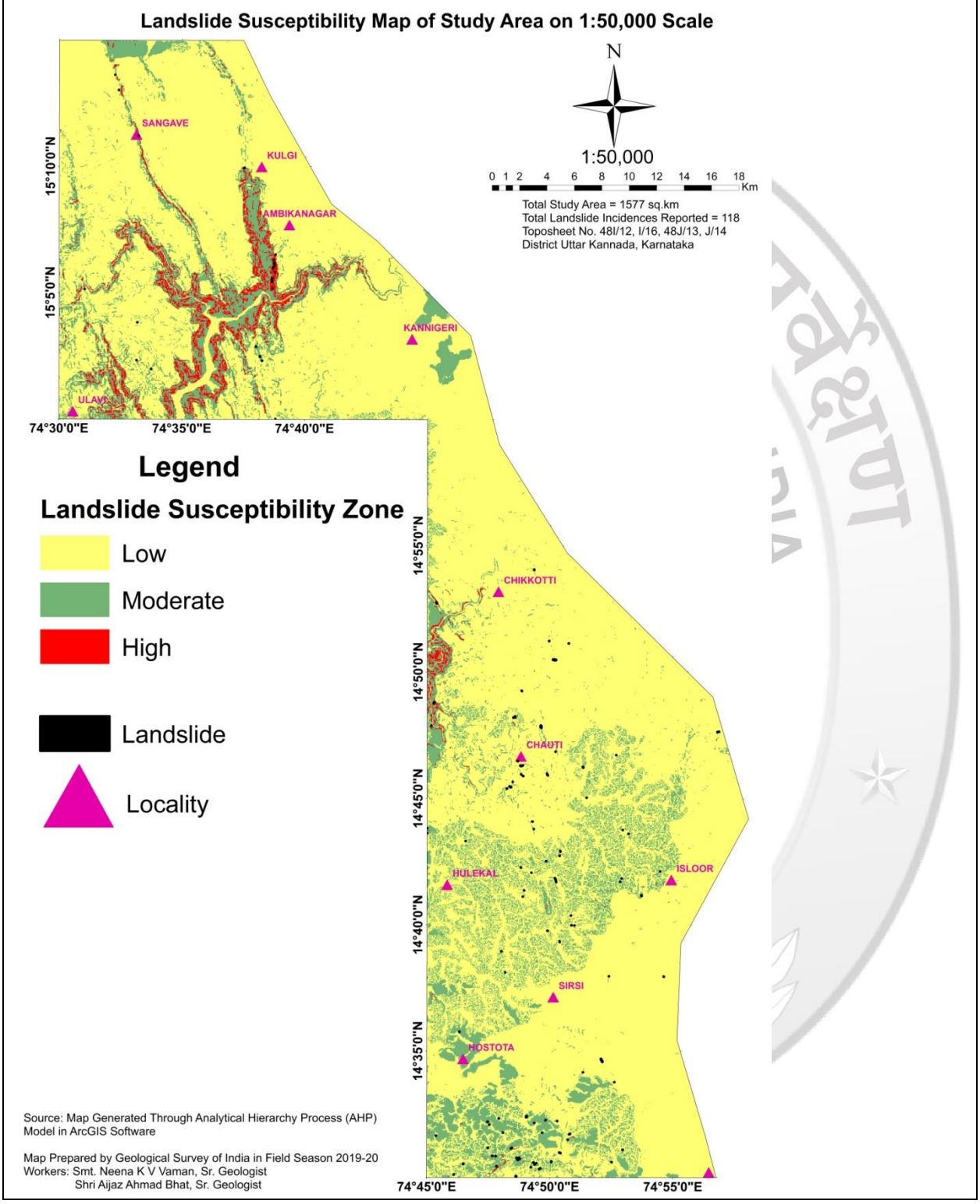


Plate 12 Landslide Susceptibility Map of parts of SOI toposheets **48I/12, 48I/16, 48J/13 and 48J/14**



Annexure 1-

Tabular 42-Point geo-parametric sheet for landslide inventory data of landslides

	Field	:	Description
	Location No	:	63
1	**Slide No**	:	1
2	**State**	:	Karnataka
3	**District**	:	Uttara Kannada
4	**Toposheet**	:	48J/14
5	**Name of Slide**	:	KAR/UK/48J14/2019/1
6	**NH/SH/Locality**	:	Kerllakoppa village
7	**Latitude**	:	14° 38' 7.564" N
8	**Longitude**	:	74° 48' 11.218" E
9	**Length**	:	10m
10	**Width**	:	10m
11	**Height**	:	8m
12	**Area**	:	100 sq.m
13	**Depth**	:	2m
14	**Volume**	:	200
15	**Run out Distance**	:	3m
16	**Type of Material**	:	Soil
17	**Type of Movement**	:	Slide
18	**Rate of movement**	:	Moderate
19	**Activity**	:	Suspended
20	**Distribution**	:	Widening, Advancing
21	**Style**	:	Single
22	**Failure Mechanism**	:	Shallow Planar Failure
23	**History**	:	Sept-Oct, 2019
24	**Geomorphology**	:	Moderately dissected
25	**Geology/ Lithology**	:	Meta-argillite
26	**Structure**	:	Nil
27	**Land use/ Land Cover**	:	Cultivation
28	**Hydrological condition**	:	Wet
29	**Triggering factor**	:	Rainfall
30	**Death of persons**	:	Nil
31	**People affected**	:	Nil
32	**Livestock loss**	:	Nil
33	**Communication**	:	Nil
34	**Infrastructure**	:	Nil

35	**Agriculture/ Forest/ Barren**	:	Agricultural land
36	**Geo-scientific causes**	:	Unplanned cutting of slope
37	**Remedial measures**	:	Toe support to be given by concrete measures
38	**Remarks, if any**	:	Nil
39	**Photo**	:	
40	**Summary/ Abstract**	:	Landslide occurred within Arecanut plantation, mainly due to unplanned cutting of slope. The toe of the slope is disturbed when soil is removed for agricultural purposes.
41	**Date of Reporting**	:	21.10.2019
42	**Landslide Category**	:	3

	Field	:	Description
	Location No	:	66
1	**Slide No**	:	2
2	**State**	:	Karnataka
3	**District**	:	Uttara Kannada
4	**Toposheet**	:	48J/14
5	**Name of Slide**	:	KAR/UK/48J14/2019/2
6	**NH/SH/Locality**	:	Devarkoppa Village
7	**Latitude**	:	14° 38' 57.713" N
8	**Longitude**	:	74° 48' 2.018" E
9	**Length**	:	35m
10	**Width**	:	20m
11	**Height**	:	30m
12	**Area**	:	700 sq.m
13	**Depth**	:	2m
14	**Volume**	:	1400 cu.m
15	**Run out Distance**	:	4m
16	**Type of Material**	:	Soil
17	**Type of Movement**	:	Slide
18	**Rate of movement**	:	Moderate
19	**Activity**	:	Suspended
20	**Distribution**	:	Advancing
21	**Style**	:	Single
22	**Failure Mechanism**	:	Shallow Planar Failure
23	**History**	:	Sept-Oct, 2019
24	**Geomorphology**	:	Lowly dissected
25	**Geology/ Lithology**	:	Soil covered
26	**Structure**	:	Nil
27	**Land use/ Land Cover**	:	Agriculture/ Forest
28	**Hydrological condition**	:	Wet
29	**Triggering factor**	:	Rainfall
30	**Death of persons**	:	Nil
31	**People affected**	:	Nil
32	**Livestock loss**	:	Nil

33	**Communication**	:	Nil
34	**Infrastructure**	:	Nil
35	**Agriculture/ Forest/ Barren**	:	Agriculture/Forest
36	**Geo-scientific causes**	:	Anthropogenic- Cut Slope
37	**Remedial measures**	:	Benching of the slope to reduce the gradient. Planting small shrubs and grass on the slope to stabilize it. The fallen material at the toe of the slope should not be removed as it adds to the stability of the slope.
38	**Remarks, if any**	:	Nil
39	**Photo**	:	
40	**Summary/ Abstract**	:	The landslide has been caused by giving cuts along the slope unscientifically. Instead of giving shallow slope angle or benching the slope, the farmers remove soil using JCB, leaving behind steep slopes which are highly vulnerable to failure.
41	**Date of Reporting**	:	21.10.2019
42	**Landslide Category**	:	3

	Field	:	Description
	Location No	:	96
1	**Slide No**	:	3
2	**State**	:	Karnataka
3	**District**	:	Uttara Kannada
4	**Toposheet**	:	48J/14
5	**Name of Slide**	:	KAR/UK/48J14/2019/3
6	**NH/SH/Locality**	:	Ajbail Village
7	**Latitude**	:	14.5964
8	**Longitude**	:	74.7721
9	**Length**	:	8m
10	**Width**	:	15m
11	**Height**	:	5m
12	**Area**	:	120 sq.m
13	**Depth**	:	1m
14	**Volume**	:	120 cu.m
15	**Run out Distance**	:	1m
16	**Type of Material**	:	Soil
17	**Type of Movement**	:	Slide
18	**Rate of movement**	:	Rapid
19	**Activity**	:	Suspended
20	**Distribution**	:	Advancing
21	**Style**	:	Single
22	**Failure Mechanism**	:	Shallow Planar Failure
23	**History**	:	Monsoon, 2019
24	**Geomorphology**	:	Lowly dissected
25	**Geology/ Lithology**	:	Soil covered
26	**Structure**	:	Nil
27	**Land use/ Land Cover**	:	Moderate Vegetation
28	**Hydrological condition**	:	Wet
29	**Triggering factor**	:	Rainfall
30	**Death of persons**	:	Nil
31	**People affected**	:	Nil
32	**Livestock loss**	:	Nil

33	**Communication**	:	Nil
34	**Infrastructure**	:	Nil
35	**Agriculture/ Forest/ Barren**	:	Agriculture/Forest
36	**Geo-scientific causes**	:	Toe erosion by stream
37	**Remedial measures**	:	Toe support to be given by concrete measures
38	**Remarks, if any**	:	Nil
39	**Photo**	:	
40	**Summary/ Abstract**	:	During heavy rains, the water in the streams increases. This sediment laden water tends to erode the toe of the slope, thereby making the upper part of the slope unstable and susceptible to failure.
41	**Date of Reporting**	:	22.10.2019
42	**Landslide Category**	:	3

	Field	:	Description
	Location No	:	99
1	**Slide No**	:	4
2	**State**	:	Karnataka
3	**District**	:	Uttara Kannada
4	**Toposheet**	:	48J/10
5	**Name of Slide**	:	KAR/UK/48J10/2019/4
6	**NH/SH/Locality**	:	Ambalike village
7	**Latitude**	:	14° 43' 38.862" N
8	**Longitude**	:	74° 44' 57.433" E
9	**Length**	:	20m
10	**Width**	:	30m
11	**Height**	:	15m
12	**Area**	:	600 sq.m
13	**Depth**	:	2m
14	**Volume**	:	1200
15	**Run out Distance**	:	3m
16	**Type of Material**	:	Soil
17	**Type of Movement**	:	Slide
18	**Rate of movement**	:	Moderate
19	**Activity**	:	Suspended
20	**Distribution**	:	Widening
21	**Style**	:	Single
22	**Failure Mechanism**	:	Shallow Planar Failure
23	**History**	:	05.08.2019
24	**Geomorphology**	:	Lowly dissected
25	**Geology/ Lithology**	:	Meta-argillite
26	**Structure**	:	Nil
27	**Land use/ Land Cover**	:	Moderate Vegetation
28	**Hydrological condition**	:	Wet
29	**Triggering factor**	:	Rainfall
30	**Death of persons**	:	Nil
31	**People affected**	:	Nil
32	**Livestock loss**	:	Nil

33	**Communication**	:	Road
34	**Infrastructure**	:	Nil
35	**Agriculture/ Forest/ Barren**	:	Agriculture/Forest
36	**Geo-scientific causes**	:	Toe erosion by stream
37	**Remedial measures**	:	Toe support to be given by concrete measures
38	**Remarks, if any**	:	If slide is not mitigated, further sliding will cause the road to give away, thereby blocking vehicular movement between adjacent villages
39	**Photo**	:	
40	**Summary/ Abstract**	:	The slide is observed on the down slope side of the road. There is a stream flowing at the base of the stream, which has eroded away the toe portion, causing the upper part of the slope to cave in.
41	**Date of Reporting**	:	23.10.2019
42	**Landslide Category**	:	3

	Field	:	Description
	Location No	:	99a
1	**Slide No**	:	5
2	**State**	:	Karnataka
3	**District**	:	Uttara Kannada
4	**Toposheet**	:	48J/10, 48J/14
5	**Name of Slide**	:	KAR/UK/48J14/2019/5
6	**NH/SH/Locality**	:	Ambalike village
7	**Latitude**	:	14° 43' 49.927" N
8	**Longitude**	:	74° 45' 0.133" E
9	**Length**	:	30m
10	**Width**	:	100m
11	**Height**	:	25m
12	**Area**	:	3000 sq.m
13	**Depth**	:	2m
14	**Volume**	:	6000 cu.m
15	**Run out Distance**	:	5m
16	**Type of Material**	:	Soil
17	**Type of Movement**	:	Slide
18	**Rate of movement**	:	Very rapid
19	**Activity**	:	Suspended
20	**Distribution**	:	Widening, Advancing
21	**Style**	:	Single
22	**Failure Mechanism**	:	Shallow Planar Failure
23	**History**	:	05.08.2019
24	**Geomorphology**	:	Lowly dissected
25	**Geology/ Lithology**	:	Meta-argillite
26	**Structure**	:	Nil
27	**Land use/ Land Cover**	:	Moderate Vegetation
28	**Hydrological condition**	:	Wet
29	**Triggering factor**	:	Rainfall
30	**Death of persons**	:	Nil
31	**People affected**	:	Stream blocked by slide, causing water to flow onto the fields
32	**Livestock loss**	:	Nil
33	**Communication**	:	Nil

34	**Infrastructure**	:	Nil
35	**Agriculture/ Forest/ Barren**	:	Agriculture/Forest
36	**Geo-scientific causes**	:	Toe erosion by stream
37	**Remedial measures**	:	Toe support is to be given by concrete measures, Slope to be benched to reduce the gradient. Slided material not to be removed so as to stabilize the slide
38	**Remarks, if any**	:	Nil
39	**Photo**	:	
40	**Summary/ Abstract**	:	The landslide has occurred due to toe erosion by the stream flowing at the base of the slope. The slide had further blocked the stream, causing the water to flow into the cultivated fields and plantation sites, causing heavy losses to the farmers.
41	**Date of Reporting**	:	23.10.2019
42	**Landslide Category**	:	1

	Field	:	Description
	Location No	:	105
1	**Slide No**	:	6
2	**State**	:	Karnataka
3	**District**	:	Uttara Kannada
4	**Toposheet**	:	48J/14
5	**Name of Slide**	:	KAR/UK/48J14/2019/6
6	**NH/SH/Locality**	:	Kodigar village
7	**Latitude**	:	14° 43' 19.519" N
8	**Longitude**	:	74° 46' 34.196" E
9	**Length**	:	6.5m
10	**Width**	:	20m
11	**Height**	:	5m
12	**Area**	:	130 sq.m
13	**Depth**	:	1m
14	**Volume**	:	130 cu.m
15	**Run out Distance**	:	2m
16	**Type of Material**	:	Debris
17	**Type of Movement**	:	Slide
18	**Rate of movement**	:	Rapid
19	**Activity**	:	Suspended
20	**Distribution**	:	Widening
21	**Style**	:	Single
22	**Failure Mechanism**	:	Shallow Planar Failure
23	**History**	:	Sept-Oct, 2019
24	**Geomorphology**	:	Lowly dissected
25	**Geology/ Lithology**	:	Meta-argillite
26	**Structure**	:	Nil
27	**Land use/ Land Cover**	:	Dense Vegetation
28	**Hydrological condition**	:	Wet
29	**Triggering factor**	:	Rainfall
30	**Death of persons**	:	Nil
31	**People affected**	:	Nil
32	**Livestock loss**	:	Nil
33	**Communication**	:	Nil

34	**Infrastructure**	:	Nil
35	**Agriculture/ Forest/ Barren**	:	Forest
36	**Geo-scientific causes**	:	Anthropogenic- Cut Slope
37	**Remedial measures**	:	Reduce the Slope gradient. Benching of Slopes along with plantation along the slope
38	**Remarks, if any**	:	Nil
39	**Photo**	:	
40	**Summary/ Abstract**	:	The slide was caused by unscientific road cuts given on the slope. Instead of benching the slope or giving a shallow angle, the steep road cuts along the roads give rise to slope failure.
41	**Date of Reporting**	:	23.10.2019
42	**Landslide Category**	:	3

	Field	:	Description
	Location No	:	111
1	**Slide No**	:	7
2	**State**	:	Karnataka
3	**District**	:	Uttara Kannada
4	**Toposheet**	:	48J/14
5	**Name of Slide**	:	KAR/UK/48J14/2019/7
6	**NH/SH/Locality**	:	Near Sonda Cross
7	**Latitude**	:	14° 44' 5.748" N
8	**Longitude**	:	74° 49' 17.274" E
9	**Length**	:	7.5m
10	**Width**	:	80m
11	**Height**	:	6m
12	**Area**	:	600 sq.m
13	**Depth**	:	1m
14	**Volume**	:	600 cu.m
15	**Run out Distance**	:	2m
16	**Type of Material**	:	Soil
17	**Type of Movement**	:	Slide
18	**Rate of movement**	:	Rapid
19	**Activity**	:	Suspended
20	**Distribution**	:	Widening
21	**Style**	:	Multiple
22	**Failure Mechanism**	:	Shallow Planar Failure
23	**History**	:	Aug-Sept 2019
24	**Geomorphology**	:	Lowly dissected
25	**Geology/ Lithology**	:	Meta argillite
26	**Structure**	:	Nil
27	**Land use/ Land Cover**	:	Moderate vegetation
28	**Hydrological condition**	:	Wet
29	**Triggering factor**	:	Rainfall
30	**Death of persons**	:	Nil
31	**People affected**	:	Nil
32	**Livestock loss**	:	Nil
33	**Communication**	:	Nil

34	**Infrastructure**	:	-
35	**Agriculture/ Forest/ Barren**	:	Forest
36	**Geo-scientific causes**	:	Toe erosion by stream
37	**Remedial measures**	:	Toe support by concrete measures. Slope to be benched
38	**Remarks, if any**	:	Stream seems to have been shifted to the side for cultivation
39	**Photo**	:	
40	**Summary/ Abstract**	:	The landslide occurred on the slopes bordering the cultivated land. There is a stream flowing at the base of the slope, causing toe erosion. The overburden thickness and vegetation on the upper slope also aided in slope failure
41	**Date of Reporting**	:	23.10.2019
42	**Landslide Category**	:	2

	Field	:	Description
	Location No	:	111a
1	**Slide No**	:	8
2	**State**	:	Karnataka
3	**District**	:	Uttara Kannada
4	**Toposheet**	:	48J/14
5	**Name of Slide**	:	KAR/UK/48J14/2019/8
6	**NH/SH/Locality**	:	Near Sonda Cross
7	**Latitude**	:	14° 43' 48.085" N
8	**Longitude**	:	74° 49' 20.692" E
9	**Length**	:	12m
10	**Width**	:	50m
11	**Height**	:	10m
12	**Area**	:	600 sq.m
13	**Depth**	:	1m
14	**Volume**	:	600 cu.m
15	**Run out Distance**	:	1.5m
16	**Type of Material**	:	Debris
17	**Type of Movement**	:	Slide
18	**Rate of movement**	:	Rapid
19	**Activity**	:	Suspended
20	**Distribution**	:	Widening
21	**Style**	:	Multiple
22	**Failure Mechanism**	:	Shallow Planar Failure
23	**History**	:	Aug-Sept 2019
24	**Geomorphology**	:	Lowly dissected
25	**Geology/ Lithology**	:	Soil covered
26	**Structure**	:	Nil
27	**Land use/ Land Cover**	:	Moderate Vegetation
28	**Hydrological condition**	:	Wet
29	**Triggering factor**	:	Rainfall
30	**Death of persons**	:	Nil
31	**People affected**	:	Nil
32	**Livestock loss**	:	Nil
33	**Communication**	:	SH 93- Road to Yellapur

34	**Infrastructure**	:	Nil
35	**Agriculture/ Forest/ Barren**	:	Forest
36	**Geo-scientific causes**	:	Anthropogenic- Cut Slope. Loading at Crown(big trees)
37	**Remedial measures**	:	Slope to be benched to reduce the gradient along with plantation on the slope
38	**Remarks, if any**	:	Slide to be mitigated, otherwise can lead to blocking of highway
39	**Photo**	:	
40	**Summary/ Abstract**	:	These are multiple landslides caused by unscientific road cuts all along the highway near Sonda Cross. The slopes have been steeply cut, and there is thick vegetation, including big trees on the upper slope, which adds to head load.
41	**Date of Reporting**	:	23.10.2019
42	**Landslide Category**	:	2

	Field	:	Description
	Location No	:	112
1	**Slide No**	:	9
2	**State**	:	Karnataka
3	**District**	:	Uttara Kannada
4	**Toposheet**	:	48J/14
5	**Name of Slide**	:	KAR/UK/48J14/2019/9
6	**NH/SH/Locality**	:	Taragod village
7	**Latitude**	:	14° 39' 46.613" N
8	**Longitude**	:	74° 49' 54.273" E
9	**Length**	:	10m
10	**Width**	:	25m
11	**Height**	:	15m
12	**Area**	:	250 sq.m
13	**Depth**	:	1m
14	**Volume**	:	NA
15	**Run out Distance**	:	2m
16	**Type of Material**	:	Debris
17	**Type of Movement**	:	Slide
18	**Rate of movement**	:	Moderate
19	**Activity**	:	Suspended
20	**Distribution**	:	Widening
21	**Style**	:	Multiple
22	**Failure Mechanism**	:	Shallow Planar Failure
23	**History**	:	July-Aug 2019
24	**Geomorphology**	:	Lowly dissected
25	**Geology/ Lithology**	:	Meta-argillite
26	**Structure**	:	
27	**Land use/ Land Cover**	:	Moderate Vegetation, Cultivation
28	**Hydrological condition**	:	Wet
29	**Triggering factor**	:	Rainfall
30	**Death of persons**	:	Nil
31	**People affected**	:	Nil
32	**Livestock loss**	:	Nil
33	**Communication**	:	Nil

34	**Infrastructure**	:	Nil
35	**Agriculture/ Forest/ Barren**	:	Forest/ Agriculture
36	**Geo-scientific causes**	:	Toe erosion by stream
37	**Remedial measures**	:	Toe support to be given by concrete measures
38	**Remarks, if any**	:	Stream was blocked by slide causing water to flow into the nearby fields, damaging crops
39	**Photo**	:	
40	**Summary/ Abstract**	:	The landslide occurred on the slopes bordering the cultivated land. There is a stream flowing at the base of the slope, causing toe erosion. The overburden thickness and vegetation on the upper slope also aided in slope failure
41	**Date of Reporting**	:	23.10.2019
42	**Landslide Category**	:	2

	Field	:	Description
	Location No	:	114
1	**Slide No**	:	10
2	**State**	:	Karnataka
3	**District**	:	Uttara Kannada
4	**Toposheet**	:	48J/14
5	**Name of Slide**	:	KAR/UK/48J14/2019/10
6	**NH/SH/Locality**	:	Taragod village
7	**Latitude**	:	14° 39' 59.071" N
8	**Longitude**	:	74° 50' 59.937" E
9	**Length**	:	10m
10	**Width**	:	150m
11	**Height**	:	8m
12	**Area**	:	1500 sq.m
13	**Depth**	:	1m
14	**Volume**	:	1500 cu.m
15	**Run out Distance**	:	2m
16	**Type of Material**	:	Soil
17	**Type of Movement**	:	Slide
18	**Rate of movement**	:	Moderate
19	**Activity**	:	Suspended
20	**Distribution**	:	Widening
21	**Style**	:	Multiple
22	**Failure Mechanism**	:	Shallow Planar Failure
23	**History**	:	Aug-19
24	**Geomorphology**	:	Lowly dissected
25	**Geology/ Lithology**	:	Meta-argillite
26	**Structure**	:	Nil
27	**Land use/ Land Cover**	:	Moderate vegetation
28	**Hydrological condition**	:	Wet
29	**Triggering factor**	:	Rainfall
30	**Death of persons**	:	Nil
31	**People affected**	:	Nil
32	**Livestock loss**	:	Nil
33	**Communication**	:	Road

34	**Infrastructure**	:	Nil
35	**Agriculture/ Forest/ Barren**	:	Nil
36	**Geo-scientific causes**	:	Toe erosion by stream
37	**Remedial measures**	:	Toe support to be given by concrete measures
38	**Remarks, if any**	:	Gravel Bed observed at the toe part
39	**Photo**	:	
40	**Summary/ Abstract**	:	The landslide occurred on the slopes bordering the cultivated land. There is a stream flowing at the base of the slope, causing toe erosion. The upper part of the slope is part of a road, hence further failure of the slope can lead to the road collapsing.
41	**Date of Reporting**	:	24.10.2019
42	**Landslide Category**	:	3

	Field	:	Description
	Location No	:	115
1	**Slide No**	:	11
2	**State**	:	Karnataka
3	**District**	:	Uttara Kannada
4	**Toposheet**	:	48J/14
5	**Name of Slide**	:	KAR/UK/48J14/2019/11
6	**NH/SH/Locality**	:	Taragod village
7	**Latitude**	:	14° 39' 59.394" N
8	**Longitude**	:	74° 50' 52.711" E
9	**Length**	:	7m
10	**Width**	:	25m
11	**Height**	:	6m
12	**Area**	:	175 sq.m
13	**Depth**	:	0.5m
14	**Volume**	:	87.7 cu.m
15	**Run out Distance**	:	1m
16	**Type of Material**	:	Soil
17	**Type of Movement**	:	Slide
18	**Rate of movement**	:	Rapid
19	**Activity**	:	Suspended
20	**Distribution**	:	Confined
21	**Style**	:	Single
22	**Failure Mechanism**	:	Shallow Planar Failure
23	**History**	:	Sep-19
24	**Geomorphology**	:	Lowly dissected
25	**Geology/ Lithology**	:	Meta-argillite
26	**Structure**	:	Nil
27	**Land use/ Land Cover**	:	Moderate Vegetation
28	**Hydrological condition**	:	Wet
29	**Triggering factor**	:	Rainfall
30	**Death of persons**	:	Nil
31	**People affected**	:	Nil
32	**Livestock loss**	:	Nil
33	**Communication**	:	Nil

34	**Infrastructure**	:	Nil
35	**Agriculture/ Forest/ Barren**	:	Nil
36	**Geo-scientific causes**	:	Toe erosion by stream
37	**Remedial measures**	:	Toe support to be given by concrete measures
38	**Remarks, if any**	:	Gravel Bed observed at the toe part
39	**Photo**	:	
40	**Summary/ Abstract**	:	There is a stream flowing at the base of the slope, causing toe erosion. The landslide occurred on the slopes bordering the cultivated land. There is a stream flowing at the base of the slope, causing toe erosion. The overburden thickness and vegetation on the upper slope also aided in slope failure
41	**Date of Reporting**	:	24.10.2019
42	**Landslide Category**	:	3

	Field	:	Description
	Location No	:	117
1	**Slide No**	:	12
2	**State**	:	Karnataka
3	**District**	:	Uttara Kannada
4	**Toposheet**	:	48J/14
5	**Name of Slide**	:	KAR/UK/48J14/2019/12
6	**NH/SH/Locality**	:	Dasangadde village
7	**Latitude**	:	14° 39' 20.803" N
8	**Longitude**	:	74° 50' 23.685" E
9	**Length**	:	25m
10	**Width**	:	15m
11	**Height**	:	20m
12	**Area**	:	375 sq.m
13	**Depth**	:	0.55m
14	**Volume**	:	187.5 cu.m
15	**Run out Distance**	:	2m
16	**Type of Material**	:	Soil
17	**Type of Movement**	:	Slide
18	**Rate of movement**	:	Moderate
19	**Activity**	:	Suspended
20	**Distribution**	:	Confined
21	**Style**	:	Single
22	**Failure Mechanism**	:	Shallow Planar Failure
23	**History**	:	Aug-19
24	**Geomorphology**	:	Lowly dissected
25	**Geology/ Lithology**	:	Soil covered
26	**Structure**	:	Nil
27	**Land use/ Land Cover**	:	Moderate Vegetation
28	**Hydrological condition**	:	Wet
29	**Triggering factor**	:	Rainfall
30	**Death of persons**	:	Nil
31	**People affected**	:	Nil
32	**Livestock loss**	:	Nil
33	**Communication**	:	Nil

34	**Infrastructure**	:	Nil
35	**Agriculture/ Forest/ Barren**	:	Agriculture/Forest
36	**Geo-scientific causes**	:	Toe erosion by stream
37	**Remedial measures**	:	Toe support to be given by concrete measures
38	**Remarks, if any**	:	Gravel Bed observed at the toe part
39	**Photo**	:	
40	**Summary/ Abstract**	:	The landslide occurred on the slopes bordering the cultivated land. There is a stream flowing at the base of the slope, causing toe erosion. The overburden thickness and vegetation on the upper slope also aided in slope failure
41	**Date of Reporting**	:	24.10.2019
42	**Landslide Category**	:	3

	Field	:	Description
	Location No	:	122
1	**Slide No**	:	13
2	**State**	:	Karnataka
3	**District**	:	Uttara Kannada
4	**Toposheet**	:	48J/14
5	**Name of Slide**	:	KAR/UK/48J14/2019/13
6	**NH/SH/Locality**	:	Agsala Village
7	**Latitude**	:	14° 41' 7.462" N
8	**Longitude**	:	74° 48' 53.863" E
9	**Length**	:	6m
10	**Width**	:	17m
11	**Height**	:	5m
12	**Area**	:	102 sq.m
13	**Depth**	:	0.5m
14	**Volume**	:	51 cu.m
15	**Run out Distance**	:	1m
16	**Type of Material**	:	Debris
17	**Type of Movement**	:	Slide
18	**Rate of movement**	:	Rapid
19	**Activity**	:	Suspended
20	**Distribution**	:	Confined
21	**Style**	:	Single
22	**Failure Mechanism**	:	Shallow Planar Failure
23	**History**	:	Aug-Sept 2019
24	**Geomorphology**	:	Lowly dissected
25	**Geology/ Lithology**	:	Meta-argillite
26	**Structure**	:	Nil
27	**Land use/ Land Cover**	:	Moderate Vegetation
28	**Hydrological condition**	:	Wet
29	**Triggering factor**	:	Rainfall
30	**Death of persons**	:	Nil
31	**People affected**	:	Nil
32	**Livestock loss**	:	Nil
33	**Communication**	:	Nil

34	**Infrastructure**	:	Nil
35	**Agriculture/ Forest/ Barren**	:	Forest
36	**Geo-scientific causes**	:	Anthropogenic-Unplanned cutting of slope
37	**Remedial measures**	:	Slope to be benched to reduce the gradient along with plantation on the slope
38	**Remarks, if any**	:	Nil
39	**Photo**	:	
40	**Summary/ Abstract**	:	The slope failure occurred due to unscientific cutting of slope for roads. The slope gradient is very high making it susceptible to failure.
41	**Date of Reporting**	:	24.10.2019
42	**Landslide Category**	:	3

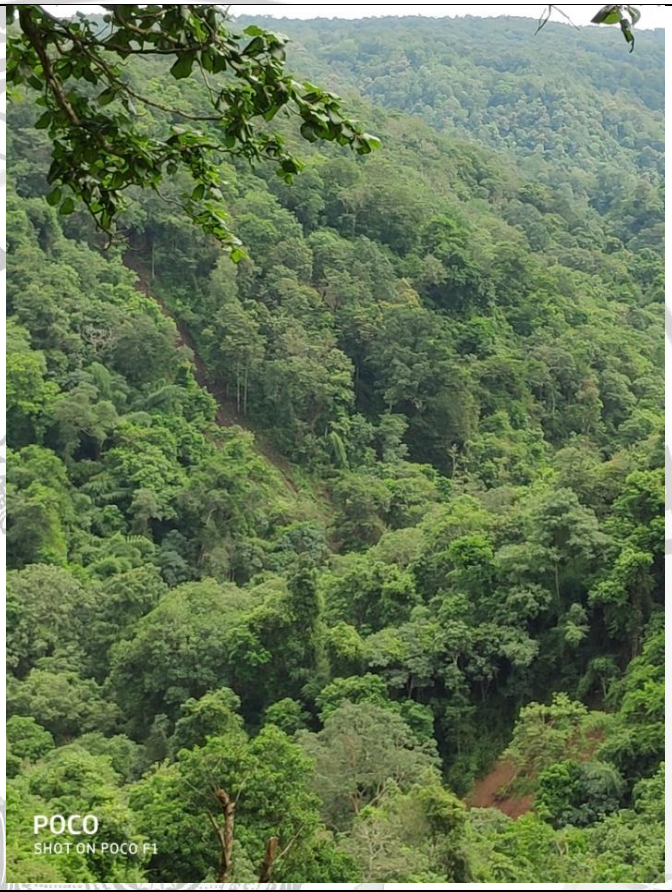
	Field	:	Description
	Location No	:	125
1	**Slide No**	:	14
2	**State**	:	Karnataka
3	**District**	:	Uttara Kannada
4	**Toposheet**	:	48J/14
5	**Name of Slide**	:	KAR/UK/48J14/2019/14
6	**NH/SH/Locality**	:	Bhairumbe Village
7	**Latitude**	:	14° 42' 4.443" N
8	**Longitude**	:	74° 49' 15.038" E
9	**Length**	:	12m
10	**Width**	:	10m
11	**Height**	:	10m
12	**Area**	:	120 sq.m
13	**Depth**	:	1m
14	**Volume**	:	120 cu.m
15	**Run out Distance**	:	2m
16	**Type of Material**	:	Soil
17	**Type of Movement**	:	Slide
18	**Rate of movement**	:	Moderate
19	**Activity**	:	Suspended
20	**Distribution**	:	Widening
21	**Style**	:	Single
22	**Failure Mechanism**	:	Shallow Planar Failure
23	**History**	:	July-Aug 2019
24	**Geomorphology**	:	Lowly dissected
25	**Geology/ Lithology**	:	Meta-argillite
26	**Structure**	:	Nil
27	**Land use/ Land Cover**	:	Moderate Vegetation
28	**Hydrological condition**	:	Wet
29	**Triggering factor**	:	Rainfall
30	**Death of persons**	:	Nil
31	**People affected**	:	Nil
32	**Livestock loss**	:	Nil
33	**Communication**	:	Nil
34	**Infrastructure**	:	Road on upper part of slope
35	**Agriculture/ Forest/ Barren**	:	Agriculture/Forest
36	**Geo-scientific causes**	:	Toe erosion by stream

37	**Remedial measures**	:	Toe support to be given by concreate measures
38	**Remarks, if any**	:	Gravel Bed observed at toe part
39	**Photo**	:	
40	**Summary/ Abstract**	:	The landslide has occurred by erosion of the toe of the slope by the stream flowing at the base. During rainfall, the water flow tends to become turbulent causing the river to erode its banks.
41	**Date of Reporting**	:	24.10.2019
42	**Landslide Category**	:	3

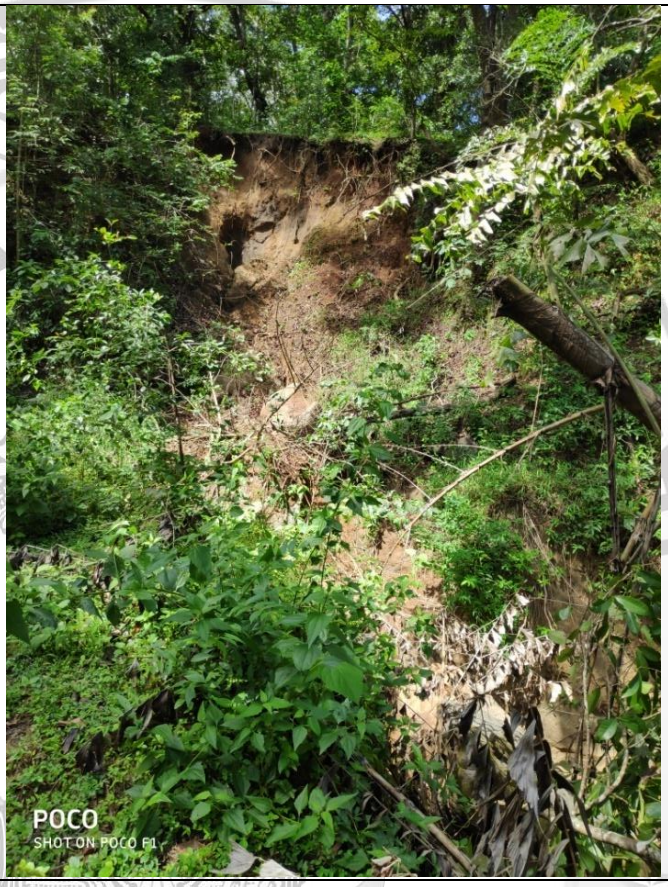
	Field	:	Description
	Location No	:	129
1	**Slide No**	:	15
2	**State**	:	Karnataka
3	**District**	:	Uttara Kannada
4	**Toposheet**	:	48I/12
5	**Name of Slide**	:	KAR/UK/48I12/2019/15
6	**NH/SH/Locality**	:	Kulgi-Phansoli Road
7	**Latitude**	:	15° 9' 57.140" N
8	**Longitude**	:	74° 37' 32.244" E
9	**Length**	:	30m
10	**Width**	:	50m
11	**Height**	:	22m
12	**Area**	:	1500 sq.m
13	**Depth**	:	6
14	**Volume**	:	9000 cu.m
15	**Run out Distance**	:	7m
16	**Type of Material**	:	Debris
17	**Type of Movement**	:	Slide
18	**Rate of movement**	:	Very rapid
19	**Activity**	:	Suspended
20	**Distribution**	:	Confined
21	**Style**	:	Single
22	**Failure Mechanism**	:	Deep Planar Failure
23	**History**	:	Oct-19
24	**Geomorphology**	:	Moderately dissected
25	**Geology/ Lithology**	:	Soil covered
26	**Structure**	:	Nil
27	**Land use/ Land Cover**	:	Dense Vegetation
28	**Hydrological condition**	:	Wet
29	**Triggering factor**	:	Rainfall
30	**Death of persons**	:	Nil
31	**People affected**	:	Nil
32	**Livestock loss**	:	Nil
33	**Communication**	:	Road
34	**Infrastructure**	:	Nil
35	**Agriculture/ Forest/ Barren**	:	Forest

36	**Geo-scientific causes**	:	Anthropogenic-Unplanned cutting of slope. Increase in pore water pressure
37	**Remedial measures**	:	Benching along Slope to reduce Slope gradient. Drains to be given on the crown to remove excess water. Perforated pipes may be given to drain out the water
38	**Remarks, if any**	:	Slide to be mitigated, otherwise can lead to blocking of highway
39	**Photo**	:	
40	**Summary/ Abstract**	:	The slope failure occurred due to unscientific cutting of slope for roads. The slope gradient is very high making it susceptible to failure. Heavy rainfall has caused increase in pore water pressure causing the slope to fail
41	**Date of Reporting**	:	28.10.2019
42	**Landslide Category**	:	1

	Field	:	Description
	Location No	:	129a
1	**Slide No**	:	16
2	**State**	:	Karnataka
3	**District**	:	Uttara Kannada
4	**Toposheet**	:	48I/12
5	**Name of Slide**	:	KAR/UK/48I12/2019/16
6	**NH/SH/Locality**	:	Kulgi-Phansoli Road
7	**Latitude**	:	15° 9' 56.681" N
8	**Longitude**	:	74° 37' 30.792" E
9	**Length**	:	35m
10	**Width**	:	10m
11	**Height**	:	20m
12	**Area**	:	350 sq.m
13	**Depth**	:	1m
14	**Volume**	:	350 cu.m
15	**Run out Distance**	:	10m
16	**Type of Material**	:	Soil
17	**Type of Movement**	:	Flow
18	**Rate of movement**	:	Very rapid
19	**Activity**	:	Suspended
20	**Distribution**	:	Confined
21	**Style**	:	Single
22	**Failure Mechanism**	:	Shallow Planar Failure
23	**History**	:	Oct-19
24	**Geomorphology**	:	Moderately dissected
25	**Geology/ Lithology**	:	Soil covered
26	**Structure**	:	Nil
27	**Land use/ Land Cover**	:	Dense Vegetation
28	**Hydrological condition**	:	Wet
29	**Triggering factor**	:	Rainfall
30	**Death of persons**	:	Nil
31	**People affected**	:	Nil
32	**Livestock loss**	:	Nil
33	**Communication**	:	Nil
34	**Infrastructure**	:	Nil
35	**Agriculture/ Forest/ Barren**	:	Forest

36	**Geo-scientific causes**	:	Toe erosion by stream
37	**Remedial measures**	:	Toe support by concrete measures. Slope to be benched
38	**Remarks, if any**	:	Slide is well within the forest.
39	**Photo**	:	
40	**Summary/ Abstract**	:	This is a natural slide observed within the forest, due to toe erosion. It is an earth flow as the length of the slide is very high and the run off distance is high.
41	**Date of Reporting**	:	28.10.2019
42	**Landslide Category**	:	3

	Field	:	Description
	Location No	:	134
1	**Slide No**	:	17
2	**State**	:	Karnataka
3	**District**	:	Uttara Kannada
4	**Toposheet**	:	48J/14
5	**Name of Slide**	:	KAR/UK/48J14/2019/17
6	**NH/SH/Locality**	:	Boppanalli village
7	**Latitude**	:	14° 41' 50.573" N
8	**Longitude**	:	74° 52' 55.139" E
9	**Length**	:	20m
10	**Width**	:	30m
11	**Height**	:	15m
12	**Area**	:	600 sq.m
13	**Depth**	:	2m
14	**Volume**	:	1200 cu.m
15	**Run out Distance**	:	4m
16	**Type of Material**	:	Soil
17	**Type of Movement**	:	Slide
18	**Rate of movement**	:	Moderate
19	**Activity**	:	Suspended
20	**Distribution**	:	Widening, Advancing
21	**Style**	:	Multiple
22	**Failure Mechanism**	:	Shallow Planar Failure
23	**History**	:	06.08.2019
24	**Geomorphology**	:	Moderately dissected
25	**Geology/ Lithology**	:	Dolerite dyke
26	**Structure**	:	Nil
27	**Land use/ Land Cover**	:	Moderate vegetation
28	**Hydrological condition**	:	Wet
29	**Triggering factor**	:	Rainfall
30	**Death of persons**	:	Nil
31	**People affected**	:	Stream blocked by slide, causing water to flow onto the fields
32	**Livestock loss**	:	Nil
33	**Communication**	:	Nil
34	**Infrastructure**	:	Nil
35	**Agriculture/ Forest/ Barren**	:	Agriculture/Forest

36	**Geo-scientific causes**	:	Toe erosion by stream. Unplanned cutting of slope
37	**Remedial measures**	:	Toe support by concrete measures. Slope to be benched along with plantation on the slope
38	**Remarks, if any**	:	Nil
39	**Photo**	:	
40	**Summary/ Abstract**	:	The landslide has occurred by erosion of the toe of the slope by the stream flowing at the base. During rainfall, the water flow tends to become turbulent causing the river to erode its banks. The landslide has blocked the stream causing the water to overflow into the adjacent fields.
41	**Date of Reporting**	:	29.10.2019
42	**Landslide Category**	:	2

	Field	:	Description
	Location No	:	134a
1	**Slide No**	:	18
2	**State**	:	Karnataka
3	**District**	:	Uttara Kannada
4	**Toposheet**	:	48J/14
5	**Name of Slide**	:	KAR/UK/48J14/2019/18
6	**NH/SH/Locality**	:	Boppanalli village
7	**Latitude**	:	14° 41' 42.893" N
8	**Longitude**	:	74° 52' 51.478" E
9	**Length**	:	15m
10	**Width**	:	25m
11	**Height**	:	12m
12	**Area**	:	375sq.m
13	**Depth**	:	1m
14	**Volume**	:	375
15	**Run out Distance**	:	2m
16	**Type of Material**	:	Debris
17	**Type of Movement**	:	Slide
18	**Rate of movement**	:	Moderate
19	**Activity**	:	Suspended
20	**Distribution**	:	Widening
21	**Style**	:	Multiple
22	**Failure Mechanism**	:	Shallow Planar Failure
23	**History**	:	06.08.2020
24	**Geomorphology**	:	Moderately dissected
25	**Geology/ Lithology**	:	Meta-argillite
26	**Structure**	:	Nil
27	**Land use/ Land Cover**	:	Moderate vegetation
28	**Hydrological condition**	:	Wet
29	**Triggering factor**	:	Rainfall
30	**Death of persons**	:	Nil
31	**People affected**	:	Stream blocked by slide, causing water to flow onto the fields
32	**Livestock loss**	:	Nil
33	**Communication**	:	Nil

34	**Infrastructure**	:	Nil
35	**Agriculture/ Forest/ Barren**	:	Agriculture/Forest
36	**Geo-scientific causes**	:	Toe erosion by stream. Unplanned cutting of slope
37	**Remedial measures**	:	Toe support by concrete measures. Slope to be benched along with plantation on the slope
38	**Remarks, if any**	:	Nil
39	**Photo**	:	
40	**Summary/ Abstract**	:	The landslide has occurred by erosion of the toe of the slope by the stream flowing at the base. During rainfall, the water flow tends to become turbulent causing the river to erode its banks. Along with the weathered material, vegetation and rock fragments have also slided along the slope.
41	**Date of Reporting**	:	29.10.2020
42	**Landslide Category**	:	2

	Field	:	Description
	Location No	:	140
1	**Slide No**	:	19
2	**State**	:	Karnataka
3	**District**	:	Uttara Kannada
4	**Toposheet**	:	48J/14
5	**Name of Slide**	:	KAR/UK/48J14/2019/19
6	**NH/SH/Locality**	:	Babankatte village
7	**Latitude**	:	14° 41' 10.059" N
8	**Longitude**	:	74° 53' 43.393" E
9	**Length**	:	30m
10	**Width**	:	75m
11	**Height**	:	8-10m
12	**Area**	:	2250sq.m
13	**Depth**	:	5m
14	**Volume**	:	11250 cu.m
15	**Run out Distance**	:	1.5m
16	**Type of Material**	:	Soil
17	**Type of Movement**	:	Subsidence
18	**Rate of movement**	:	Very slow
19	**Activity**	:	Suspended
20	**Distribution**	:	Advancing
21	**Style**	:	Multiple
22	**Failure Mechanism**	:	Deep Planar Failure
23	**History**	:	2018-2019
24	**Geomorphology**	:	Lowly dissected
25	**Geology/ Lithology**	:	Meta argillite, Laterite
26	**Structure**	:	Nil
27	**Land use/ Land Cover**	:	Cultivation, HHP
28	**Hydrological condition**	:	Wet

29	**Triggering factor**	:	Rainfall
30	**Death of persons**	:	Nil
31	**People affected**	:	Nil
32	**Livestock loss**	:	Nil
33	**Communication**	:	Nil
34	**Infrastructure**	:	Nil
35	**Agriculture/ Forest/ Barren**	:	Agriculture
36	**Geo-scientific causes**	:	Increase in pore water pressure. Loading at head
37	**Remedial measures**	:	Proper drainage management. Add perforated pipes and connect them by common drainage
38	**Remarks, if any**	:	Nil
39	**Photo**	:	
40	**Summary/ Abstract**	:	Increased rainfall in the area and modifications of land for cultivation, accompanied by blocking of streams has led to subsidence in the area. Cracks have developed parallel to the crown all along the area, and these cracks are filled with water during the rains. This increases the pore water pressure.
41	**Date of Reporting**	:	29.10.2019
42	**Landslide Category**	:	1

	Field	:	Description
	Location No	:	159
1	**Slide No**	:	20
2	**State**	:	Karnataka
3	**District**	:	Uttara Kannada
4	**Toposheet**	:	48J/14
5	**Name of Slide**	:	KAR/UK/48J14/2019/20
6	**NH/SH/Locality**	:	Tataguni village
7	**Latitude**	:	14° 32' 20.814" N
8	**Longitude**	:	74° 47' 55.733" E
9	**Length**	:	6m
10	**Width**	:	5m
11	**Height**	:	7m
12	**Area**	:	30sq.m
13	**Depth**	:	1m
14	**Volume**	:	30 cu.m
15	**Run out Distance**	:	2m
16	**Type of Material**	:	Debris
17	**Type of Movement**	:	Slide
18	**Rate of movement**	:	Moderate
19	**Activity**	:	Suspended
20	**Distribution**	:	Widening
21	**Style**	:	Single
22	**Failure Mechanism**	:	Shallow Planar Failure
23	**History**	:	2018 Monsoon
24	**Geomorphology**	:	Lowly dissected
25	**Geology/ Lithology**	:	Meta argillite, Laterite
26	**Structure**	:	Nil
27	**Land use/ Land Cover**	:	Cultivation, HHP
28	**Hydrological condition**	:	Wet
29	**Triggering factor**	:	Rainfall
30	**Death of persons**	:	Nil
31	**People affected**	:	Nil
32	**Livestock loss**	:	Nil
33	**Communication**	:	Road

34	**Infrastructure**	:	Nil
35	**Agriculture/ Forest/ Barren**	:	Agriculture
36	**Geo-scientific causes**	:	Unplanned cutting of slope
37	**Remedial measures**	:	Add toe support by concrete measures. Reduce gradient of slope by benching. Add plantation to stabilize the slope
38	**Remarks, if any**	:	Nil
39	**Photo**	:	
40	**Summary/ Abstract**	:	The slope failure occurred due to unscientific cutting of slope for roads. The slope gradient is very high making it susceptible to failure. The slope may be stabilized by benching it to reduce the gradient.
41	**Date of Reporting**	:	02.11.2019
42	**Landslide Category**	:	3

	Field	:	Description
	Location No	:	161
1	**Slide No**	:	21
2	**State**	:	Karnataka
3	**District**	:	Uttara Kannada
4	**Toposheet**	:	48J/14
5	**Name of Slide**	:	KAR/UK/48J14/2019/21
6	**NH/SH/Locality**	:	Doddamanekere village
7	**Latitude**	:	14° 31' 47.110" N
8	**Longitude**	:	74° 48' 6.097" E
9	**Length**	:	8m
10	**Width**	:	6m
11	**Height**	:	7m
12	**Area**	:	48sq.m
13	**Depth**	:	1m
14	**Volume**	:	48
15	**Run out Distance**	:	1m
16	**Type of Material**	:	Debris
17	**Type of Movement**	:	Slide
18	**Rate of movement**	:	Moderate
19	**Activity**	:	Suspended
20	**Distribution**	:	Advancing
21	**Style**	:	Single
22	**Failure Mechanism**	:	Shallow Planar Failure
23	**History**	:	Oct-Sept 2019
24	**Geomorphology**	:	Moderately dissected
25	**Geology/ Lithology**	:	Meta argillite
26	**Structure**	:	Nil
27	**Land use/ Land Cover**	:	Moderate vegetation
28	**Hydrological condition**	:	Wet
29	**Triggering factor**	:	Rainfall
30	**Death of persons**	:	Nil
31	**People affected**	:	Nil
32	**Livestock loss**	:	Nil
33	**Communication**	:	Nil
34	**Infrastructure**	:	Nil
35	**Agriculture/ Forest/ Barren**	:	Forest

36	**Geo-scientific causes**	:	Unplanned cutting of slope
37	**Remedial measures**	:	Add toe support by concrete measures. Reduce gradient of slope by benching. Add plantation to stabilize the slope
38	**Remarks, if any**	:	Nil
39	**Photo**	:	
40	**Summary/ Abstract**	:	The slope failure occurred due to unscientific cutting of slope for roads. The slope gradient is very high making it susceptible to failure. The meta argillite is highly weathered and jointed making it highly susceptible to failure.
41	**Date of Reporting**	:	02.11.2019
42	**Landslide Category**	:	2

	Field	:	Description
	Location No	:	166
1	**Slide No**	:	22
2	**State**	:	Karnataka
3	**District**	:	Uttara Kannada
4	**Toposheet**	:	48J/14
5	**Name of Slide**	:	KAR/UK/48J14/2019/22
6	**NH/SH/Locality**	:	Ajjibail village
7	**Latitude**	:	14° 32' 10.112" N
8	**Longitude**	:	74° 49' 22.269" E
9	**Length**	:	6m
10	**Width**	:	25m
11	**Height**	:	5m
12	**Area**	:	150sq.m
13	**Depth**	:	1m
14	**Volume**	:	150 cu.m
15	**Run out Distance**	:	1.5m
16	**Type of Material**	:	Soil
17	**Type of Movement**	:	Slide
18	**Rate of movement**	:	Moderate
19	**Activity**	:	Suspended
20	**Distribution**	:	Advancing
21	**Style**	:	Single
22	**Failure Mechanism**	:	Shallow Planar Failure
23	**History**	:	Sept-Oct 2019
24	**Geomorphology**	:	Moderately dissected
25	**Geology/ Lithology**	:	Soil covered
26	**Structure**	:	Nil
27	**Land use/ Land Cover**	:	Dense vegetation
28	**Hydrological condition**	:	Wet
29	**Triggering factor**	:	Rainfall
30	**Death of persons**	:	Nil
31	**People affected**	:	Nil
32	**Livestock loss**	:	Nil
33	**Communication**	:	Nil

34	**Infrastructure**	:	Nil
35	**Agriculture/ Forest/ Barren**	:	Forest
36	**Geo-scientific causes**	:	Unplanned cutting of slope
37	**Remedial measures**	:	Toe support by concrete measures along with plantation along the slope
38	**Remarks, if any**	:	Nil
39	**Photo**	:	
40	**Summary/ Abstract**	:	The slope failure occurred due to unscientific cutting of slope for roads. The thick vegetation on the upper slope adds to the head load.
41	**Date of Reporting**	:	02.11.2019
42	**Landslide Category**	:	3

	Field	:	Description
	Location No	:	173
1	**Slide No**	:	23
2	**State**	:	Karnataka
3	**District**	:	Uttara Kannada
4	**Toposheet**	:	48J/09
5	**Name of Slide**	:	KAR/UK/48J09/2019/23
6	**NH/SH/Locality**	:	Jajjigudda village
7	**Latitude**	:	14° 45' 7.385" N
8	**Longitude**	:	74° 41' 46.183" E
9	**Length**	:	50m
10	**Width**	:	20m
11	**Height**	:	25m
12	**Area**	:	1000sq.m
13	**Depth**	:	5
14	**Volume**	:	5000 cu.m
15	**Run out Distance**	:	2m
16	**Type of Material**	:	Debris
17	**Type of Movement**	:	Slide
18	**Rate of movement**	:	Moderate
19	**Activity**	:	Suspended
20	**Distribution**	:	Advancing
21	**Style**	:	Complex
22	**Failure Mechanism**	:	Deep Planar Failure
23	**History**	:	August-Spet 2019
24	**Geomorphology**	:	Moderately dissected
25	**Geology/ Lithology**	:	Soil covered
26	**Structure**	:	Nil
27	**Land use/ Land Cover**	:	Sparse to moderate vegetation
28	**Hydrological condition**	:	Dry
29	**Triggering factor**	:	Rainfall
30	**Death of persons**	:	Nil
31	**People affected**	:	Nil
32	**Livestock loss**	:	Nil
33	**Communication**	:	Road

34	**Infrastructure**	:	Nil
35	**Agriculture/ Forest/ Barren**	:	Agriculture/ Forest
36	**Geo-scientific causes**	:	Reduction of strength on Super Saturation
37	**Remedial measures**	:	Toe support by concrete measures along with plantation along the slope
38	**Remarks, if any**	:	Nil
39	**Photo**	:	
40	**Summary/ Abstract**	:	A debris slide was observed. The material forming the slope was highly pulverized and the rock fragments present showed signs of deformation. The slide has multiple scarps and the cracks extend quite deep from the surface. The extension of the cracks was checked along the cultivated slopes and it was found to be quite deep.
41	**Date of Reporting**	:	26.11.2019
42	**Landslide Category**	:	11

	Field	:	Description
	Location No	:	173a
1	**Slide No**	:	24
2	**State**	:	Karnataka
3	**District**	:	Uttara Kannada
4	**Toposheet**	:	48J/09
5	**Name of Slide**	:	KAR/UK/48J09/2019/24
6	**NH/SH/Locality**	:	Jajjigudda village
7	**Latitude**	:	14° 45' 11.743" N
8	**Longitude**	:	74° 41' 50.218" E
9	**Length**	:	25m
10	**Width**	:	50m
11	**Height**	:	20m
12	**Area**	:	1250sq.m
13	**Depth**	:	5m
14	**Volume**	:	6250 cu.m
15	**Run out Distance**	:	3m
16	**Type of Material**	:	Debris
17	**Type of Movement**	:	Slide
18	**Rate of movement**	:	Rapid
19	**Activity**	:	Suspended
20	**Distribution**	:	Advancing
21	**Style**	:	Complex
22	**Failure Mechanism**	:	Deep Planar Failure
23	**History**	:	Oct-Sept 2019
24	**Geomorphology**	:	Moderately dissected
25	**Geology/ Lithology**	:	Soil covered
26	**Structure**	:	Nil
27	**Land use/ Land Cover**	:	Moderate vegetation, Cultivation
28	**Hydrological condition**	:	Dry
29	**Triggering factor**	:	Rainfall
30	**Death of persons**	:	Nil
31	**People affected**	:	Nil
32	**Livestock loss**	:	Nil
33	**Communication**	:	Nil

34	**Infrastructure**	:	Nil
35	**Agriculture/ Forest/ Barren**	:	Agriculture/ Forest
36	**Geo-scientific causes**	:	Unplanned cutting of slope
37	**Remedial measures**	:	Toe support by concrete measures. Proper drainage arrangement
38	**Remarks, if any**	:	Nil
39	**Photo**	:	
40	**Summary/ Abstract**	:	Multiple cracks have been reported near the settlements and within the forest as well. All these features indicate a complex slide, which is a combination of different kinds of landslides. At certain road cuttings, gouge formation (a clayey material formed along fault planes) is observed. Extensive lateritisation is also observed along the slopes. Again as the slopes are so steep, lateritisation is not usually expected.
41	**Date of Reporting**	:	26.11.2019
42	**Landslide Category**	:	1

	Field	:	Description
	Location No	:	182
1	**Slide No**	:	25
2	**State**	:	Karnataka
3	**District**	:	Uttara Kannada
4	**Toposheet**	:	48J/14
5	**Name of Slide**	:	KAR/UK/48J14/2019/25
6	**NH/SH/Locality**	:	Chalagdde village
7	**Latitude**	:	14° 32' 25.096" N
8	**Longitude**	:	74° 49' 3.049" E
9	**Length**	:	80m
10	**Width**	:	175m
11	**Height**	:	30m
12	**Area**	:	14000sq.m
13	**Depth**	:	5m
14	**Volume**	:	70000
15	**Run out Distance**	:	10m
16	**Type of Material**	:	Soil
17	**Type of Movement**	:	Slide
18	**Rate of movement**	:	Moderate
19	**Activity**	:	Suspended
20	**Distribution**	:	Widening
21	**Style**	:	Multiple
22	**Failure Mechanism**	:	Deep Planar Failure
23	**History**	:	Monsoon 2019
24	**Geomorphology**	:	Moderately dissected
25	**Geology/ Lithology**	:	Soil covered
26	**Structure**	:	Nil
27	**Land use/ Land Cover**	:	Moderate vegetation
28	**Hydrological condition**	:	Dry
29	**Triggering factor**	:	Rainfall
30	**Death of persons**	:	Nil
31	**People affected**	:	Nil
32	**Livestock loss**	:	Nil
33	**Communication**	:	Nil
34	**Infrastructure**	:	Nil
35	**Agriculture/ Forest/ Barren**	:	Forest
36	**Geo-scientific causes**	:	Toe erosion by stream. Thick overburden

37	**Remedial measures**	:	Appropriate toe cupport by providing retaining wall or gabion wall. Stepping of slope to reduce the gradient near the crown along with plantation on the slope
38	**Remarks, if any**	:	
39	**Photo**	:	Due to the thick vegetation, photo of the landslide could not be taken.
40	**Summary/ Abstract**	:	This slide is observed within a moderately vegetated slope. The overburden thickness is very high,. The stream flowing at the base of the slope eroded the toe of the slope leading to failure.
41	**Date of Reporting**	:	29.11.2019
42	**Landslide Category**	:	3

	Field	:	Description
	Location No	:	188
1	**Slide No**	:	26
2	**State**	:	Karnataka
3	**District**	:	Uttara Kannada
4	**Toposheet**	:	48J/14
5	**Name of Slide**	:	KAR/UK/48J14/2019/26
6	**NH/SH/Locality**	:	Tudguni village
7	**Latitude**	:	14° 32' 5.783" N
8	**Longitude**	:	74° 47' 32.448" E
9	**Length**	:	7m
10	**Width**	:	6m
11	**Height**	:	5m
12	**Area**	:	42 sq.m
13	**Depth**	:	1m
14	**Volume**	:	42 cu.m
15	**Run out Distance**	:	1m
16	**Type of Material**	:	Soil
17	**Type of Movement**	:	Slide
18	**Rate of movement**	:	Rapid
19	**Activity**	:	Suspended
20	**Distribution**	:	Advancing
21	**Style**	:	Single
22	**Failure Mechanism**	:	Shallow Planar Failure
23	**History**	:	Monsoon 2019
24	**Geomorphology**	:	Lowly dissected
25	**Geology/ Lithology**	:	Soil covered
26	**Structure**	:	Nil
27	**Land use/ Land Cover**	:	Cultivation, HHP
28	**Hydrological condition**	:	Dry
29	**Triggering factor**	:	Rainfall
30	**Death of persons**	:	Nil
31	**People affected**	:	Nil
32	**Livestock loss**	:	Nil
33	**Communication**	:	Nil
34	**Infrastructure**	:	Nil

35	**Agriculture/ Forest/ Barren**	:	Agriculture
36	**Geo-scientific causes**	:	Unplanned cutting of slope
37	**Remedial measures**	:	Toe support. Stepping of slope
38	**Remarks, if any**	:	Nil
39	**Photo**	:	
40	**Summary/ Abstract**	:	Unplanned cutting of slope for cultivation purpose had led to slope failure. During monsoons, the unit mass of the sloe increase. This accompanied by existing head load causes slope to fail.
41	**Date of Reporting**	:	29.11.2019
42	**Landslide Category**	:	3

	Field	:	Description
	Location No	:	189
1	**Slide No**	:	27
2	**State**	:	Karnataka
3	**District**	:	Uttara Kannada
4	**Toposheet**	:	48J/14
5	**Name of Slide**	:	KAR/UK/48J14/2019/27
6	**NH/SH/Locality**	:	Tudguni village
7	**Latitude**	:	14° 32' 13.000" N
8	**Longitude**	:	74° 47' 28.516" E
9	**Length**	:	10m
10	**Width**	:	20m
11	**Height**	:	7m
12	**Area**	:	200 sq.m
13	**Depth**	:	2m
14	**Volume**	:	400 cu.m
15	**Run out Distance**	:	1m
16	**Type of Material**	:	Debris
17	**Type of Movement**	:	Slide
18	**Rate of movement**	:	Moderate
19	**Activity**	:	Suspended
20	**Distribution**	:	Widening
21	**Style**	:	Single
22	**Failure Mechanism**	:	Shallow Planar Failure
23	**History**	:	Monsoon 2019
24	**Geomorphology**	:	Lowly dissected
25	**Geology/ Lithology**	:	Meta argillite
26	**Structure**	:	Jointed, foliated
27	**Land use/ Land Cover**	:	Moderate vegetation
28	**Hydrological condition**	:	Dry
29	**Triggering factor**	:	Rainfall
30	**Death of persons**	:	Nil
31	**People affected**	:	Nil
32	**Livestock loss**	:	Nil
33	**Communication**	:	Road

34	**Infrastructure**	:	Nil
35	**Agriculture/ Forest/ Barren**	:	Nil
36	**Geo-scientific causes**	:	Unplanned cutting of slope. Increase of unit mass due to water saturation
37	**Remedial measures**	:	Breast wall with weep holes. Drainage maintenance along with plantation along the slope
38	**Remarks, if any**	:	Nil
39	**Photo**	:	
40	**Summary/ Abstract**	:	Unplanned cutting of slope for widening of roads has led to slope failure. During monsoons, the unit mass of the sloe increase. This accompanied by existing head load has caused the slope to fail.
41	**Date of Reporting**	:	29.11.2019
42	**Landslide Category**	:	3

	Field	:	Description
	Location No	:	190
1	**Slide No**	:	28
2	**State**	:	Karnataka
3	**District**	:	Uttara Kannada
4	**Toposheet**	:	48J/14
5	**Name of Slide**	:	KAR/UK/48J14/2019/28
6	**NH/SH/Locality**	:	Jananalli village
7	**Latitude**	:	14° 31' 47.209" N
8	**Longitude**	:	74° 49' 41.352" E
9	**Length**	:	20m
10	**Width**	:	50m
11	**Height**	:	15m
12	**Area**	:	1000 sq.m
13	**Depth**	:	2m
14	**Volume**	:	2000 cu.m
15	**Run out Distance**	:	4m
16	**Type of Material**	:	Soil
17	**Type of Movement**	:	Slide
18	**Rate of movement**	:	Moderate
19	**Activity**	:	Reactivated
20	**Distribution**	:	Advancing
21	**Style**	:	Multiple
22	**Failure Mechanism**	:	Shallow Planar Failure
23	**History**	:	old slide reactivated
24	**Geomorphology**	:	Moderately dissected
25	**Geology/ Lithology**	:	Meta argillite
26	**Structure**	:	Jointed, fractured
27	**Land use/ Land Cover**	:	Cultivation, HHP
28	**Hydrological condition**	:	Wet
29	**Triggering factor**	:	Rainfall
30	**Death of persons**	:	Nil
31	**People affected**	:	Nil
32	**Livestock loss**	:	Nil

33	**Communication**	:	Road
34	**Infrastructure**	:	Nil
35	**Agriculture/ Forest/ Barren**	:	Nil
36	**Geo-scientific causes**	:	Unplanned cutting of slope. Toe cut for agricultural purposes, increase in unit mass along slope by water saturation
37	**Remedial measures**	:	Benching upslope. Material at toe of slope not to be removed. Drainage arrangement to drain the infiltrated water during rains
38	**Remarks, if any**	:	Nil
39	**Photo**	:	
40	**Summary/ Abstract**	:	Unplanned cutting of slope for cultivation purpose had led to slope failure. During monsoons, the unit mass of the sloe increase. This accompanied by existing head load caused slope to fail. Moreover the farmers tend to remove the loose material at the base of the slope, further reducing the stability.
41	**Date of Reporting**	:	30.11.2019
42	**Landslide Category**	:	3

	Field	:	Description
	Location No	:	192
1	**Slide No**	:	29
2	**State**	:	Karnataka
3	**District**	:	Uttara Kannada
4	**Toposheet**	:	48J/14
5	**Name of Slide**	:	KAR/UK/48J14/2019/29
6	**NH/SH/Locality**	:	Guddetata village
7	**Latitude**	:	14° 30' 27.460" N
8	**Longitude**	:	74° 47' 50.200" E
9	**Length**	:	30m
10	**Width**	:	60m
11	**Height**	:	15m
12	**Area**	:	1800 sq.m
13	**Depth**	:	5m
14	**Volume**	:	9000 cu.m
15	**Run out Distance**	:	10m
16	**Type of Material**	:	Soil
17	**Type of Movement**	:	Slide
18	**Rate of movement**	:	Rapid
19	**Activity**	:	Suspended
20	**Distribution**	:	Confined
21	**Style**	:	Single
22	**Failure Mechanism**	:	Deep Planar Failure
23	**History**	:	Monsoon 2019
24	**Geomorphology**	:	Moderately dissected
25	**Geology/ Lithology**	:	Soil covered
26	**Structure**	:	Nil
27	**Land use/ Land Cover**	:	Moderate vegetation
28	**Hydrological condition**	:	Dry
29	**Triggering factor**	:	Rainfall
30	**Death of persons**	:	Nil
31	**People affected**	:	Nil
32	**Livestock loss**	:	Nil
33	**Communication**	:	Nil

34	**Infrastructure**	:	Nil
35	**Agriculture/ Forest/ Barren**	:	Forest
36	**Geo-scientific causes**	:	Reduction on super saturation. Toe erosion by stream. Loading at head region.
37	**Remedial measures**	:	Provide contour drain along the slope, which should be properly maintained as well. Bench the slope and provide plantation along the slope
38	**Remarks, if any**	:	Increase in unit mass due to water saturation. The head load on the slope increased by presence of big trees. The stream has also eroded the toe of the slope.
39	**Photo**	:	
40	**Summary/ Abstract**	:	. During monsoons, the unit mass of the slope has increased. This accompanied by existing head load has caused the slope to fail.
41	**Date of Reporting**	:	30.11.2019
42	**Landslide Category**	:	3

	Field	:	Description
	Location No	:	202
1	**Slide No**	:	30
2	**State**	:	Karnataka
3	**District**	:	Uttara Kannada
4	**Toposheet**	:	48J/13
5	**Name of Slide**	:	KAR/UK/48J13/2019/30
6	**NH/SH/Locality**	:	Kummanmane village
7	**Latitude**	:	14° 45' 24.338" N
8	**Longitude**	:	74° 48' 15.038" E
9	**Length**	:	15m
10	**Width**	:	70m
11	**Height**	:	8m
12	**Area**	:	1050 sq.m
13	**Depth**	:	1.5m
14	**Volume**	:	1575 cu.m
15	**Run out Distance**	:	4m
16	**Type of Material**	:	Soil
17	**Type of Movement**	:	Slide
18	**Rate of movement**	:	Rapid
19	**Activity**	:	Suspended
20	**Distribution**	:	Widening
21	**Style**	:	Multiple
22	**Failure Mechanism**	:	Shallow Planar Failure
23	**History**	:	Monsoon 2019
24	**Geomorphology**	:	PPC
25	**Geology/ Lithology**	:	Meta argillite, Phyllite
26	**Structure**	:	Foliation
27	**Land use/ Land Cover**	:	Cultivation
28	**Hydrological condition**	:	Wet
29	**Triggering factor**	:	Rainfall
30	**Death of persons**	:	Nil
31	**People affected**	:	Nil
32	**Livestock loss**	:	Nil

33	**Communication**	:	Nil
34	**Infrastructure**	:	Nil
35	**Agriculture/ Forest/ Barren**	:	Agriculture
36	**Geo-scientific causes**	:	Toe erosion by stream
37	**Remedial measures**	:	Toe support by concrete measures
38	**Remarks, if any**	:	Stream is cutting its right bank in a quite rapid manner with a minor shifting
39	**Photo**	:	
40	**Summary/ Abstract**	:	The landslide has occurred by erosion of the toe of the slope by the stream flowing at the base. During rainfall, the water flow tends to become turbulent causing the river to erode its banks. Along with the weathered material, vegetation and rock fragments have also slided along the slope.
41	**Date of Reporting**	:	05.12.2019
42	**Landslide Category**	:	3

	Field	:	Description
	Location No	:	203
1	**Slide No**	:	31
2	**State**	:	Karnataka
3	**District**	:	Uttara Kannada
4	**Toposheet**	:	48J/13
5	**Name of Slide**	:	KAR/UK/48J13/2019/31
6	**NH/SH/Locality**	:	Kummanmane village
7	**Latitude**	:	74° 48' 21.468" E
8	**Longitude**	:	74° 48' 21.468" E
9	**Length**	:	10m
10	**Width**	:	15m
11	**Height**	:	8m
12	**Area**	:	150 sq.m
13	**Depth**	:	1m
14	**Volume**	:	150
15	**Run out Distance**	:	3m
16	**Type of Material**	:	Soil
17	**Type of Movement**	:	Slide
18	**Rate of movement**	:	Rapid
19	**Activity**	:	Suspended
20	**Distribution**	:	Confined
21	**Style**	:	Single
22	**Failure Mechanism**	:	Shallow Planar Failure
23	**History**	:	Monsoon 2019
24	**Geomorphology**	:	Moderately dissected
25	**Geology/ Lithology**	:	Meta argillite
26	**Structure**	:	Nil
27	**Land use/ Land Cover**	:	Cultivation, Forest
28	**Hydrological condition**	:	Dry
29	**Triggering factor**	:	Rainfall
30	**Death of persons**	:	Nil
31	**People affected**	:	Nil
32	**Livestock loss**	:	Nil
33	**Communication**	:	Nil

34	**Infrastructure**	:	Nil
35	**Agriculture/ Forest/ Barren**	:	Agriculture/ Forest
36	**Geo-scientific causes**	:	Unplanned cutting of slope
37	**Remedial measures**	:	Give cut slopes at gentle gradients. Toe support by concrete measures along with plantation on the slope
38	**Remarks, if any**	:	Nil
39	**Photo**	:	
40	**Summary/ Abstract**	:	Unplanned cutting of slope for cultivation purpose had led to slope failure. During monsoons, the unit mass of the sloe increase. This accompanied by existing head load caused the slope to fail.
41	**Date of Reporting**	:	05.12.2019
42	**Landslide Category**	:	3

	Field	:	Description
	Location No	:	204
1	**Slide No**	:	32
2	**State**	:	Karnataka
3	**District**	:	Uttara Kannada
4	**Toposheet**	:	48J/13
5	**Name of Slide**	:	KAR/UK/48J13/2019/32
6	**NH/SH/Locality**	:	Kummanmane village
7	**Latitude**	:	14° 45' 27.687" N
8	**Longitude**	:	74° 48' 25.114" E
9	**Length**	:	10m
10	**Width**	:	30m
11	**Height**	:	6m
12	**Area**	:	300 sq.m
13	**Depth**	:	1m
14	**Volume**	:	300 cu.m
15	**Run out Distance**	:	2m
16	**Type of Material**	:	Soil
17	**Type of Movement**	:	Slide
18	**Rate of movement**	:	Moderate
19	**Activity**	:	Suspended
20	**Distribution**	:	Widening
21	**Style**	:	Multiple
22	**Failure Mechanism**	:	Shallow Planar Failure
23	**History**	:	Monsoon 2019
24	**Geomorphology**	:	Moderately dissected
25	**Geology/ Lithology**	:	Meta argillite
26	**Structure**	:	Nil
27	**Land use/ Land Cover**	:	Cultivation/ Forest
28	**Hydrological condition**	:	Dry
29	**Triggering factor**	:	Rainfall
30	**Death of persons**	:	Nil
31	**People affected**	:	Nil
32	**Livestock loss**	:	Nil

33	**Communication**	:	Nil
34	**Infrastructure**	:	Nil
35	**Agriculture/ Forest/ Barren**	:	Agriculture/ Forest
36	**Geo-scientific causes**	:	Unplanned cutting of slope
37	**Remedial measures**	:	Toe support by concreate measures. Decrease the slope gradient along with plantations on the slope
38	**Remarks, if any**	:	Nil
39	**Photo**	:	
40	**Summary/ Abstract**	:	Unplanned cutting of slope for cultivation purpose had led to slope failure. During monsoons, the unit mass of the slope increased, this accompanied by existing head load caused the slope to fail.
41	**Date of Reporting**	:	05.12.2019
42	**Landslide Category**	:	3

	Field	:	Description
	Location No	:	206
1	**Slide No**	:	33
2	**State**	:	Karnataka
3	**District**	:	Uttara Kannada
4	**Toposheet**	:	48J/13
5	**Name of Slide**	:	KAR/UK/48J13/2019/33
6	**NH/SH/Locality**	:	Kummanmane village
7	**Latitude**	:	14° 45' 39.986" N
8	**Longitude**	:	74° 48' 29.273" E
9	**Length**	:	20m
10	**Width**	:	25m
11	**Height**	:	10m
12	**Area**	:	500 sq.m
13	**Depth**	:	1m
14	**Volume**	:	500 cu.m
15	**Run out Distance**	:	3m
16	**Type of Material**	:	Soil
17	**Type of Movement**	:	Slide
18	**Rate of movement**	:	Moderate
19	**Activity**	:	Suspended
20	**Distribution**	:	Advancing, Widening
21	**Style**	:	Multiple
22	**Failure Mechanism**	:	Deep Planar Failure
23	**History**	:	Monsoon 2019, but paleo slides nearby
24	**Geomorphology**	:	Moderately dissected
25	**Geology/ Lithology**	:	Meta argillite
26	**Structure**	:	Nil
27	**Land use/ Land Cover**	:	Cultivation/ Forest
28	**Hydrological condition**	:	Dry
29	**Triggering factor**	:	Rainfall
30	**Death of persons**	:	Nil
31	**People affected**	:	Nil
32	**Livestock loss**	:	Nil
33	**Communication**	:	Nil

34	**Infrastructure**	:	Nil
35	**Agriculture/ Forest/ Barren**	:	Agriculture/ Forest
36	**Geo-scientific causes**	:	Toe erosion by stream
37	**Remedial measures**	:	Toe support by concrete measures
38	**Remarks, if any**	:	River is cutting its slopes leaving wide valleys behind
39	**Photo**	:	
40	**Summary/ Abstract**	:	The landslide has occurred by erosion of the toe of the slope by the stream flowing at the base. During rainfall, the water flow tends to become turbulent causing the river to erode its banks. Along with the weathered material, vegetation and rock fragments have also slided along the slope.
41	**Date of Reporting**	:	05.12.2019
42	**Landslide Category**	:	3

	Field	:	Description
	Location No	:	211
1	**Slide No**	:	34
2	**State**	:	Karnataka
3	**District**	:	Uttara Kannada
4	**Toposheet**	:	48J/13
5	**Name of Slide**	:	KAR/UK/48J13/2019/34
6	**NH/SH/Locality**	:	Chauti village
7	**Latitude**	:	14° 46' 18.352" N
8	**Longitude**	:	74° 48' 51.694" E
9	**Length**	:	50m
10	**Width**	:	250m
11	**Height**	:	20m
12	**Area**	:	12500 sq.m
13	**Depth**	:	1.5m
14	**Volume**	:	18750 cu.m
15	**Run out Distance**	:	2m
16	**Type of Material**	:	Soil
17	**Type of Movement**	:	Slide
18	**Rate of movement**	:	Rapid
19	**Activity**	:	Suspended
20	**Distribution**	:	Advancing, Widening
21	**Style**	:	Multiple
22	**Failure Mechanism**	:	Shallow Planar Failure
23	**History**	:	Monsoon 2019
24	**Geomorphology**	:	Moderately dissected
25	**Geology/ Lithology**	:	Soil covered
26	**Structure**	:	Nil
27	**Land use/ Land Cover**	:	Cultivation/ Forest
28	**Hydrological condition**	:	Dry
29	**Triggering factor**	:	Rainfall
30	**Death of persons**	:	Nil
31	**People affected**	:	Nil
32	**Livestock loss**	:	Nil
33	**Communication**	:	Nil

34	**Infrastructure**	:	Nil
35	**Agriculture/ Forest/ Barren**	:	Agriculture/ Forest
36	**Geo-scientific causes**	:	Unplanned cutting of slope
37	**Remedial measures**	:	Toe support by concrete measures. Decrease the slope gradient
38	**Remarks, if any**	:	Owners have stabilized the slope by constructing small scale walls from logs and tree branches.
39	**Photo**	:	
40	**Summary/ Abstract**	:	Unplanned cutting of slope for cultivation purpose had led to slope failure. During monsoons, the unit mass of the slope increased, this accompanied by existing head load caused the slope to fail.
41	**Date of Reporting**	:	05.12.2019
42	**Landslide Category**	:	3

	Field	:	Description
	Location No	:	219
1	**Slide No**	:	35
2	**State**	:	Karnataka
3	**District**	:	Uttara Kannada
4	**Toposheet**	:	48J/14
5	**Name of Slide**	:	KAR/UK/48J14/2019/35
6	**NH/SH/Locality**	:	Kanchimane village
7	**Latitude**	:	14° 30' 50.972" N
8	**Longitude**	:	74° 47' 48.228" E
9	**Length**	:	10m
10	**Width**	:	10m
11	**Height**	:	8m
12	**Area**	:	100 sq.m
13	**Depth**	:	1m
14	**Volume**	:	100
15	**Run out Distance**	:	2m
16	**Type of Material**	:	Soil
17	**Type of Movement**	:	Slide
18	**Rate of movement**	:	Moderate
19	**Activity**	:	Suspended
20	**Distribution**	:	Confined
21	**Style**	:	Multiple
22	**Failure Mechanism**	:	Shallow Planar Failure
23	**History**	:	Monsoon 2020
24	**Geomorphology**	:	Moderately dissected
25	**Geology/ Lithology**	:	Soil covered
26	**Structure**	:	Nil
27	**Land use/ Land Cover**	:	Forest
28	**Hydrological condition**	:	Dry
29	**Triggering factor**	:	Rainfall
30	**Death of persons**	:	Nil
31	**People affected**	:	Nil
32	**Livestock loss**	:	Nil
33	**Communication**	:	Nil

34	**Infrastructure**	:	Nil
35	**Agriculture/ Forest/ Barren**	:	Forest
36	**Geo-scientific causes**	:	Unplanned cutting of slope
37	**Remedial measures**	:	Toe support of slope cut by concrete measures along with plantation along the slope
38	**Remarks, if any**	:	Nil
39	**Photo**	:	
40	**Summary/ Abstract**	:	Unplanned cutting of slope for cultivation purpose had led to slope failure. During monsoons, the unit mass of the slope increased, this accompanied by existing head load caused the slope to fail.
41	**Date of Reporting**	:	06.12.2019
42	**Landslide Category**	:	3

	Field	:	Description
	Location No	:	220
1	**Slide No**	:	36
2	**State**	:	Karnataka
3	**District**	:	Uttara Kannada
4	**Toposheet**	:	48J/14
5	**Name of Slide**	:	KAR/UK/48J14/2019/36
6	**NH/SH/Locality**	:	Halligeri village
7	**Latitude**	:	14° 30' 52.046" N
8	**Longitude**	:	74° 47' 40.171" E
9	**Length**	:	10m
10	**Width**	:	20m
11	**Height**	:	6m
12	**Area**	:	200 sq.m
13	**Depth**	:	1m
14	**Volume**	:	200 cu.m
15	**Run out Distance**	:	1m
16	**Type of Material**	:	Soil
17	**Type of Movement**	:	Slide
18	**Rate of movement**	:	Moderate
19	**Activity**	:	Suspended
20	**Distribution**	:	Confined
21	**Style**	:	Single
22	**Failure Mechanism**	:	Shallow Planar Failure
23	**History**	:	Old slide
24	**Geomorphology**	:	Moderately dissected
25	**Geology/ Lithology**	:	Soil covered
26	**Structure**	:	Nil
27	**Land use/ Land Cover**	:	Moderate vegetation/ HHP
28	**Hydrological condition**	:	Dry
29	**Triggering factor**	:	Rainfall
30	**Death of persons**	:	Nil
31	**People affected**	:	Nil
32	**Livestock loss**	:	Nil
33	**Communication**	:	Nil

34	**Infrastructure**	:	Nil
35	**Agriculture/ Forest/ Barren**	:	Forest
36	**Geo-scientific causes**	:	Unplanned cutting of slope
37	**Remedial measures**	:	Toe support of slope cut by concrete measures. Slope easing by benching along with plantation along the slope.
38	**Remarks, if any**	:	Nil
39	**Photo**	:	
40	**Summary/ Abstract**	:	Unplanned cutting of slope for widening of road had led to slope failure. During monsoons, the unit mass of the slope increased, this accompanied by existing head load caused the slope to fail. The slope material is highly pulverized and clayey in nature, similar to gouge.
41	**Date of Reporting**	:	06.12.2019
42	**Landslide Category**	:	2

	Field	:	Description
	Location No	:	221a
1	**Slide No**	:	37
2	**State**	:	Karnataka
3	**District**	:	Uttara Kannada
4	**Toposheet**	:	48J/14
5	**Name of Slide**	:	KAR/UK/48J14/2019/37
6	**NH/SH/Locality**	:	North of Halligeri village
7	**Latitude**	:	14° 31' 10.920" N
8	**Longitude**	:	74° 47' 29.252" E
9	**Length**	:	10m
10	**Width**	:	10m
11	**Height**	:	5m
12	**Area**	:	100 sq.m
13	**Depth**	:	0.5m
14	**Volume**	:	50 cu.m
15	**Run out Distance**	:	2m
16	**Type of Material**	:	Soil
17	**Type of Movement**	:	Slide
18	**Rate of movement**	:	Moderate
19	**Activity**	:	Suspended
20	**Distribution**	:	Advancing
21	**Style**	:	Single
22	**Failure Mechanism**	:	Shallow Planar Failure
23	**History**	:	Monsoon 2019
24	**Geomorphology**	:	Moderately dissected
25	**Geology/ Lithology**	:	Meta argillite
26	**Structure**	:	Fractured, Jointed
27	**Land use/ Land Cover**	:	Moderate vegetation
28	**Hydrological condition**	:	Dry
29	**Triggering factor**	:	Rainfall
30	**Death of persons**	:	Nil
31	**People affected**	:	Nil
32	**Livestock loss**	:	Nil
33	**Communication**	:	Nil

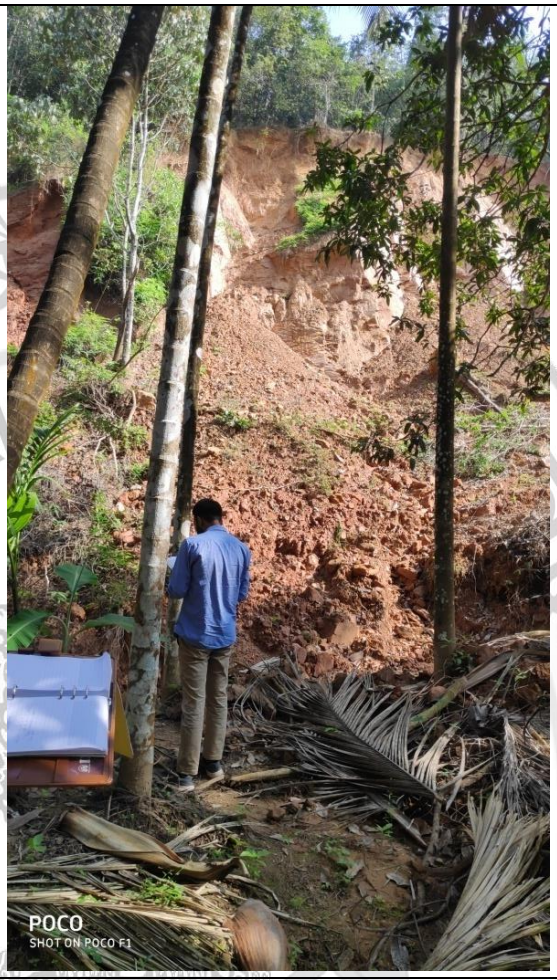
34	**Infrastructure**	:	Nil
35	**Agriculture/ Forest/ Barren**	:	Forest
36	**Geo-scientific causes**	:	Unplanned cutting of slopes
37	**Remedial measures**	:	Toe support by concrete measures along with plantation along the slope
38	**Remarks, if any**	:	Nil
39	**Photo**	:	
40	**Summary/ Abstract**	:	Unplanned cutting of slope for constructing roads has led to slope failure. During monsoons, the unit mass of the slope increased, this accompanied by existing head load caused the slope to fail.
41	**Date of Reporting**	:	06.12.2019
42	**Landslide Category**	:	2

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	Field	:	Description
	Location No	:	225
1	**Slide No**	:	38
2	**State**	:	Karnataka
3	**District**	:	Uttara Kannada
4	**Toposheet**	:	48J/13
5	**Name of Slide**	:	KAR/UK/48J13/2019/38
6	**NH/SH/Locality**	:	Chauti village
7	**Latitude**	:	14° 46' 18.627" N
8	**Longitude**	:	74° 48' 47.389" E
9	**Length**	:	10m
10	**Width**	:	20m
11	**Height**	:	5m
12	**Area**	:	200 sq.m
13	**Depth**	:	1m
14	**Volume**	:	200 cu.m
15	**Run out Distance**	:	2m
16	**Type of Material**	:	Soil
17	**Type of Movement**	:	Slide
18	**Rate of movement**	:	Moderate
19	**Activity**	:	Suspended
20	**Distribution**	:	Advancing, Widening
21	**Style**	:	Single
22	**Failure Mechanism**	:	Shallow Planar Failure
23	**History**	:	Monsoon 2019
24	**Geomorphology**	:	Moderately dissected
25	**Geology/ Lithology**	:	Soil covered
26	**Structure**	:	Nil
27	**Land use/ Land Cover**	:	Forest, HHP
28	**Hydrological condition**	:	Dry
29	**Triggering factor**	:	Rainfall
30	**Death of persons**	:	Nil
31	**People affected**	:	Nil
32	**Livestock loss**	:	Nil

33	**Communication**	:	Nil
34	**Infrastructure**	:	Nil
35	**Agriculture/ Forest/ Barren**	:	Agriculture
36	**Geo-scientific causes**	:	Unplanned cutting of slopes
37	**Remedial measures**	:	Toe support by concrete measures and plantation along the slope.
38	**Remarks, if any**	:	Nil
39	**Photo**	:	
40	**Summary/ Abstract**	:	Unplanned cutting of slope for cultivation purpose had led to slope failure. During monsoons, the unit mass of the slope increased, this accompanied by existing head load caused the slope to fail.
41	**Date of Reporting**	:	07.12.2019
42	**Landslide Category**	:	3

	Field	:	Description
	Location No	:	231
1	**Slide No**	:	39
2	**State**	:	Karnataka
3	**District**	:	Uttara Kannada
4	**Toposheet**	:	48J/13
5	**Name of Slide**	:	KAR/UK/48J13/2019/39
6	**NH/SH/Locality**	:	Hitlalli village
7	**Latitude**	:	14° 48' 14.048" N
8	**Longitude**	:	74° 48' 34.800" E
9	**Length**	:	20m
10	**Width**	:	500m
11	**Height**	:	18m
12	**Area**	:	10000 sq.m
13	**Depth**	:	5m
14	**Volume**	:	50000 cu.m
15	**Run out Distance**	:	5m
16	**Type of Material**	:	Debris
17	**Type of Movement**	:	Slide
18	**Rate of movement**	:	Rapid
19	**Activity**	:	Suspended
20	**Distribution**	:	Advancing, Widening
21	**Style**	:	Multiple
22	**Failure Mechanism**	:	Deep Planar Failure
23	**History**	:	Monsoon 2019
24	**Geomorphology**	:	Moderately dissected
25	**Geology/ Lithology**	:	Meta argillite
26	**Structure**	:	Jointed
27	**Land use/ Land Cover**	:	Cultivation/ Forest
28	**Hydrological condition**	:	Dry
29	**Triggering factor**	:	Rainfall
30	**Death of persons**	:	Nil
31	**People affected**	:	Nil
32	**Livestock loss**	:	Nil
33	**Communication**	:	Nil
34	**Infrastructure**	:	Nil
35	**Agriculture/ Forest/ Barren**	:	Agriculture/ Forest
36	**Geo-scientific causes**	:	Toe erosion by stream
37	**Remedial measures**	:	Toe support by concrete measures. Plantation may be given on the slopes to stabilize it
38	**Remarks, if any**	:	Nil

39	**Photo**	:	
40	**Summary/ Abstract**	:	The landslide has occurred by erosion of the toe of the slope by the stream flowing at the base. During rainfall, the water flow tends to become turbulent causing the river to erode its banks. Along with the weathered material, vegetation and rock fragments have also slided along the slope.
41	**Date of Reporting**	:	07.012.2019
42	**Landslide Category**	:	2

	Field	:	Description
	Location No	:	231a
1	**Slide No**	:	40
2	**State**	:	Karnataka
3	**District**	:	Uttara Kannada
4	**Toposheet**	:	48J/13
5	**Name of Slide**	:	KAR/UK/48J14/2019/40
6	**NH/SH/Locality**	:	Hitlalli village
7	**Latitude**	:	14° 48' 12.543" N
8	**Longitude**	:	74° 48' 30.557" E
9	**Length**	:	15m
10	**Width**	:	30m
11	**Height**	:	10m
12	**Area**	:	450 sq.m
13	**Depth**	:	2m
14	**Volume**	:	900 cu.m
15	**Run out Distance**	:	5m
16	**Type of Material**	:	Debris
17	**Type of Movement**	:	Slide
18	**Rate of movement**	:	Moderate
19	**Activity**	:	Suspended
20	**Distribution**	:	Widening
21	**Style**	:	Single
22	**Failure Mechanism**	:	Shallow Planar Failure
23	**History**	:	Monsoon 2020
24	**Geomorphology**	:	Moderately dissected
25	**Geology/ Lithology**	:	Soil covered
26	**Structure**	:	Nil
27	**Land use/ Land Cover**	:	Forest
28	**Hydrological condition**	:	Flowing
29	**Triggering factor**	:	Rainfall
30	**Death of persons**	:	Nil
31	**People affected**	:	Nil
32	**Livestock loss**	:	Nil

33	**Communication**	:	Nil
34	**Infrastructure**	:	Nil
35	**Agriculture/ Forest/ Barren**	:	Forest
36	**Geo-scientific causes**	:	Unplanned cutting of slope
37	**Remedial measures**	:	Plantation along the slope with slope grading is recommended.
38	**Remarks, if any**	:	Nil
39	**Photo**	:	
40	**Summary/ Abstract**	:	The slopes have been modified extensively for the purpose of settlements and cultivation. Unscientific slope cuts have caused the slope to fail.
41	**Date of Reporting**	:	07.12.2019
42	**Landslide Category**	:	2

	Field	:	Description
	Location No	:	247
1	**Slide No**	:	41
2	**State**	:	Karnataka
3	**District**	:	Uttara Kannada
4	**Toposheet**	:	48J/13
5	**Name of Slide**	:	KAR/UK/48J13/2019/41
6	**NH/SH/Locality**	:	Harigadde-Arbail village
7	**Latitude**	:	14° 48' 47.768" N
8	**Longitude**	:	74° 45' 17.444" E
9	**Length**	:	100m
10	**Width**	:	30m
11	**Height**	:	80m
12	**Area**	:	3000 sq.m
13	**Depth**	:	5m
14	**Volume**	:	15000 cu.m
15	**Run out Distance**	:	20m
16	**Type of Material**	:	Debris
17	**Type of Movement**	:	Slide
18	**Rate of movement**	:	Very Rapid
19	**Activity**	:	Suspended
20	**Distribution**	:	Widening
21	**Style**	:	Single
22	**Failure Mechanism**	:	Deep Planar Failure
23	**History**	:	Aug-September, 2019
24	**Geomorphology**	:	Escarpment
25	**Geology/ Lithology**	:	Meta argillite/ meta phyllite
26	**Structure**	:	Nil
27	**Land use/ Land Cover**	:	Dense vegetation
28	**Hydrological condition**	:	Dry
29	**Triggering factor**	:	Rainfall
30	**Death of persons**	:	Nil
31	**People affected**	:	Nil
32	**Livestock loss**	:	Nil

33	**Communication**	:	Nil
34	**Infrastructure**	:	Nil
35	**Agriculture/ Forest/ Barren**	:	Forest
36	**Geo-scientific causes**	:	Toe erosion by stream. Steep Slope on escarpment. Gully erosion
37	**Remedial measures**	:	Toe to be supported by appropriate measures. Slope to be benched.
38	**Remarks, if any**	:	Numerous small streams flowing along the slope. May cause gully erosion along the slope
39	**Photo**	:	
40	**Summary/ Abstract**	:	The landslide has occurred by erosion of the toe of the slope by the stream flowing at the base. The slide is well within a forest and has occurred under natural conditions. During rainfall, the water flow tends to become turbulent causing the river to erode its banks. Along with the weathered material, vegetation and rock fragments have also slided along the slope.
41	**Date of Reporting**	:	09.12.2020
42	**Landslide Category**	:	3

	Field	:	Description
	Location No	:	248
1	**Slide No**	:	42
2	**State**	:	Karnataka
3	**District**	:	Uttara Kannada
4	**Toposheet**	:	48J/13
5	**Name of Slide**	:	KAR/UK/48J13/2019/42
6	**NH/SH/Locality**	:	East of Ganeshpal village, Shivaganga Falls
7	**Latitude**	:	14° 47' 53.638" N
8	**Longitude**	:	74° 45' 10.671" E
9	**Length**	:	10m
10	**Width**	:	10m
11	**Height**	:	8m
12	**Area**	:	100 sq.m
13	**Depth**	:	0.5m
14	**Volume**	:	50 cu.m
15	**Run out Distance**	:	2m
16	**Type of Material**	:	Debris
17	**Type of Movement**	:	Slide
18	**Rate of movement**	:	Rapid
19	**Activity**	:	Suspended
20	**Distribution**	:	Confined
21	**Style**	:	Single
22	**Failure Mechanism**	:	Shallow Planar Failure
23	**History**	:	Monsoon 2020
24	**Geomorphology**	:	Escarpment
25	**Geology/ Lithology**	:	Metaphyllite/Dolerite
26	**Structure**	:	Nil
27	**Land use/ Land Cover**	:	Moderate vegetation
28	**Hydrological condition**	:	Dry
29	**Triggering factor**	:	Rainfall
30	**Death of persons**	:	Nil
31	**People affected**	:	Nil
32	**Livestock loss**	:	Nil

33	**Communication**	:	Nil
34	**Infrastructure**	:	Nil
35	**Agriculture/ Forest/ Barren**	:	Forest
36	**Geo-scientific causes**	:	Toe erosion by stream
37	**Remedial measures**	:	Toe support by concrete measures along with plantation on the slope
38	**Remarks, if any**	:	Nil
39	**Photo**	:	
40	**Summary/ Abstract**	:	The landslide has occurred by erosion of the toe of the slope by the stream flowing at the base. During rainfall, the water flow tends to become turbulent causing the river to erode its banks. Along with the weathered material, vegetation and rock fragments have also slided along the slope.
41	**Date of Reporting**	:	10.12.2020
42	**Landslide Category**	:	3

	Field	:	Description
	Location No	:	263
1	**Slide No**	:	43
2	**State**	:	Karnataka
3	**District**	:	Uttara Kannada
4	**Toposheet**	:	48J/13
5	**Name of Slide**	:	KAR/UK/48J13/2019/43
6	**NH/SH/Locality**	:	Atbail village
7	**Latitude**	:	14° 47' 39.010" N
8	**Longitude**	:	74° 56' 50.442" E
9	**Length**	:	35m
10	**Width**	:	50m
11	**Height**	:	30m
12	**Area**	:	1750 sq.m
13	**Depth**	:	1m
14	**Volume**	:	1750 cu.m
15	**Run out Distance**	:	5m
16	**Type of Material**	:	Soil
17	**Type of Movement**	:	Slide
18	**Rate of movement**	:	Rapid
19	**Activity**	:	Suspended
20	**Distribution**	:	Advancing, Widening
21	**Style**	:	Multiple
22	**Failure Mechanism**	:	Shallow Planar Failure
23	**History**	:	Monsoon 2020
24	**Geomorphology**	:	Moderately dissected
25	**Geology/ Lithology**	:	Meta argillite
26	**Structure**	:	Nil
27	**Land use/ Land Cover**	:	Moderate vegetation, Cultivation
28	**Hydrological condition**	:	Flowing
29	**Triggering factor**	:	Rainfall
30	**Death of persons**	:	Nil
31	**People affected**	:	Nil
32	**Livestock loss**	:	Nil

33	**Communication**	:	Road
34	**Infrastructure**	:	Nil
35	**Agriculture/ Forest/ Barren**	:	Agriculture, Forest
36	**Geo-scientific causes**	:	Toe erosion by stream
37	**Remedial measures**	:	Toe support by concrete measures along with plantation along the slope.
38	**Remarks, if any**	:	The stream has shifted from its normal course, cutting both banks and leaving wide valleys
39	**Photo**	:	
40	**Summary/ Abstract**	:	The landslide has occurred by erosion of the toe of the slope by the stream flowing at the base. During rainfall, the water flow tends to become turbulent causing the river to erode its banks. Along with the weathered material, vegetation and rock fragments have also slided along the slope.
41	**Date of Reporting**	:	14.12.2020
42	**Landslide Category**	:	3

	Field	:	Description
	Location No	:	273
1	**Slide No**	:	44
2	**State**	:	Karnataka
3	**District**	:	Uttara Kannada
4	**Toposheet**	:	48J/13
5	**Name of Slide**	:	KAR/UK/48J14/2019/44
6	**NH/SH/Locality**	:	Tarehalli village
7	**Latitude**	:	14° 45' 57.737" N
8	**Longitude**	:	74° 49' 53.682" E
9	**Length**	:	10m
10	**Width**	:	50m
11	**Height**	:	5m
12	**Area**	:	500 sq.m
13	**Depth**	:	4m
14	**Volume**	:	2000 cu.m
15	**Run out Distance**	:	3m
16	**Type of Material**	:	Soil
17	**Type of Movement**	:	Slide
18	**Rate of movement**	:	Rapid
19	**Activity**	:	Suspended
20	**Distribution**	:	Advancing, Widening
21	**Style**	:	Complex
22	**Failure Mechanism**	:	Deep Planar Failure
23	**History**	:	Monsoon 2020
24	**Geomorphology**	:	Moderately dissected
25	**Geology/ Lithology**	:	Meta argillite
26	**Structure**	:	Nil
27	**Land use/ Land Cover**	:	Moderate vegetation, Cultivation
28	**Hydrological condition**	:	Flowing
29	**Triggering factor**	:	Rainfall
30	**Death of persons**	:	Nil
31	**People affected**	:	Nil
32	**Livestock loss**	:	Nil

33	**Communication**	:	Nil
34	**Infrastructure**	:	Nil
35	**Agriculture/ Forest/ Barren**	:	Agriculture
36	**Geo-scientific causes**	:	Toe erosion by stream. Reduction of strength on super saturation
37	**Remedial measures**	:	Toe support by concrete measures. Give perforated drain holes and proper drainage arrangements. Remove check points, barriers from main stream.
38	**Remarks, if any**	:	Nil
39	**Photo**	:	
40	**Summary/ Abstract**	:	The landslide has occurred by erosion of the toe of the slope by the stream flowing at the base. During rainfall, the water flow tends to become turbulent causing the river to erode its banks. Along with the weathered material, vegetation and rock fragments have also slided along the slope. The owners of the land tend to remove the debris at the base of the slope causing it to fail further.
41	**Date of Reporting**	:	17.12.2020
42	**Landslide Category**	:	3

	Field	:	Description
	Location No	:	275
1	**Slide No**	:	45
2	**State**	:	Karnataka
3	**District**	:	Uttara Kannada
4	**Toposheet**	:	48J/13
5	**Name of Slide**	:	KAR/UK/48J13/2019/45
6	**NH/SH/Locality**	:	North of Kannur village
7	**Latitude**	:	14° 46' 14.757" N
8	**Longitude**	:	74° 51' 20.683" E
9	**Length**	:	12m
10	**Width**	:	50m
11	**Height**	:	10m
12	**Area**	:	600 sq.m
13	**Depth**	:	2m
14	**Volume**	:	1200 cu.m
15	**Run out Distance**	:	1m
16	**Type of Material**	:	Soil
17	**Type of Movement**	:	Slide
18	**Rate of movement**	:	Rapid
19	**Activity**	:	Suspended
20	**Distribution**	:	Advancing, Widening
21	**Style**	:	Multiple
22	**Failure Mechanism**	:	Shallow Planar Failure
23	**History**	:	Monsoon 2020
24	**Geomorphology**	:	Moderately dissected
25	**Geology/ Lithology**	:	Soil covered
26	**Structure**	:	Nil
27	**Land use/ Land Cover**	:	Moderate vegetation
28	**Hydrological condition**	:	Dry
29	**Triggering factor**	:	Rainfall
30	**Death of persons**	:	Nil
31	**People affected**	:	Nil
32	**Livestock loss**	:	Nil

33	**Communication**	:	Nil
34	**Infrastructure**	:	Nil
35	**Agriculture/ Forest/ Barren**	:	Agriculture
36	**Geo-scientific causes**	:	Toe erosion by stream
37	**Remedial measures**	:	Toe support by concreate measures. Remove check points, barriers from main stream.
38	**Remarks, if any**	:	Stream shifting is in progress
39	**Photo**	:	
40	**Summary/ Abstract**	:	The landslide has occurred by erosion of the toe of the slope by the stream flowing at the base. During rainfall, the water flow tends to become turbulent causing the river to erode its banks. Along with the weathered material, vegetation and rock fragments have also slided along the slope.
41	**Date of Reporting**	:	17.12.2020
42	**Landslide Category**	:	3

	Field	:	Description
	Location No	:	284
1	**Slide No**	:	46
2	**State**	:	Karnataka
3	**District**	:	Uttara Kannada
4	**Toposheet**	:	48J/13
5	**Name of Slide**	:	KAR/UK/48J14/2019/46
6	**NH/SH/Locality**	:	Mankulli village
7	**Latitude**	:	14° 52' 44.903" N
8	**Longitude**	:	74° 45' 23.069" E
9	**Length**	:	25m
10	**Width**	:	70m
11	**Height**	:	10m
12	**Area**	:	1750 sq.m
13	**Depth**	:	1m
14	**Volume**	:	1750 cu.m
15	**Run out Distance**	:	5m
16	**Type of Material**	:	Debris
17	**Type of Movement**	:	Slide
18	**Rate of movement**	:	Rapid
19	**Activity**	:	Suspended
20	**Distribution**	:	Advancing, Widening
21	**Style**	:	Complex
22	**Failure Mechanism**	:	Deep Planar Failure
23	**History**	:	Monsoon 2020
24	**Geomorphology**	:	Moderately dissected
25	**Geology/ Lithology**	:	Metta phyllite
26	**Structure**	:	
27	**Land use/ Land Cover**	:	Moderate vegetation, Cultivation
28	**Hydrological condition**	:	Flowing
29	**Triggering factor**	:	Rainfall
30	**Death of persons**	:	
31	**People affected**	:	
32	**Livestock loss**	:	

33	**Communication**	:	Road
34	**Infrastructure**	:	House
35	**Agriculture/ Forest/ Barren**	:	Agriculture
36	**Geo-scientific causes**	:	Unplanned cutting of slope, Reduction of strength on super saturation
37	**Remedial measures**	:	Avoid Slope cutting. Proper drainage arrangements. Toe support at base of slope and plantation on slopes
38	**Remarks, if any**	:	Nil
39	**Photo**	:	
40	**Summary/ Abstract**	:	The slope was extensively modified for cultivation. Moreover the stream flowing at the base has also eroded the toe. During rainfall, the water flowing from the upper slopes has caused the slope to fail.
41	**Date of Reporting**	:	18.12.2020
42	**Landslide Category**	:	1

	Field	:	Description
	Location No	:	319
1	**Slide No**	:	47
2	**State**	:	Karnataka
3	**District**	:	Uttara Kannada
4	**Toposheet**	:	48J/14
5	**Name of Slide**	:	KAR/UK/48J14/2019/47
6	**NH/SH/Locality**	:	Byagadde village
7	**Latitude**	:	14° 37' 57.747" N
8	**Longitude**	:	74° 54' 37.773" E
9	**Length**	:	5m
10	**Width**	:	20m
11	**Height**	:	3m
12	**Area**	:	100 sq.m
13	**Depth**	:	2m
14	**Volume**	:	200 cu.m
15	**Run out Distance**	:	2m
16	**Type of Material**	:	Soil
17	**Type of Movement**	:	Slide
18	**Rate of movement**	:	Moderate
19	**Activity**	:	Suspended
20	**Distribution**	:	Widening
21	**Style**	:	Single
22	**Failure Mechanism**	:	Shallow Planar Failure
23	**History**	:	Monsoon 2020
24	**Geomorphology**	:	PPC
25	**Geology/ Lithology**	:	Transported material
26	**Structure**	:	Nil
27	**Land use/ Land Cover**	:	Cultivation
28	**Hydrological condition**	:	Dry
29	**Triggering factor**	:	Rainfall
30	**Death of persons**	:	Nil
31	**People affected**	:	Nil
32	**Livestock loss**	:	Nil
33	**Communication**	:	Nil
34	**Infrastructure**	:	Nil
35	**Agriculture/ Forest/ Barren**	:	Agriculture
36	**Geo-scientific causes**	:	Toe erosion by stream, guly erosion

37	**Remedial measures**	:	Toe support by appropriate measures. Avoid removing material from foot of slope. Maintain drainage properly
38	**Remarks, if any**	:	Nil
39	**Photo**	:	The cracks caused by sliding were filled and the road completely repaired. No visual evidences of the slide were observed.
40	**Summary/ Abstract**	:	The earth slide occurred due to overflowing of the water from the lake adjacent to the area. the water washed away a part of the slope, causing it to fail. The mud road had numerous cracks post sliding which were filled overtime by the localities.
41	**Date of Reporting**	:	24.12.2019
42	**Landslide Category**	:	32

	Field	:	Description
	Location No	:	323
1	**Slide No**	:	48
2	**State**	:	Karnataka
3	**District**	:	Uttara Kannada
4	**Toposheet**	:	48J/14
5	**Name of Slide**	:	KAR/UK/48J14/2019/48
6	**NH/SH/Locality**	:	NE of Else village
7	**Latitude**	:	14° 37' 58.573" N
8	**Longitude**	:	74° 52' 24.145" E
9	**Length**	:	6m
10	**Width**	:	100m
11	**Height**	:	3m
12	**Area**	:	600 sq.m
13	**Depth**	:	0.5m
14	**Volume**	:	300 cu.m
15	**Run out Distance**	:	2m
16	**Type of Material**	:	Debris
17	**Type of Movement**	:	Slide
18	**Rate of movement**	:	Moderate
19	**Activity**	:	Suspended
20	**Distribution**	:	Widening
21	**Style**	:	Multiple
22	**Failure Mechanism**	:	Shallow Planar Failure
23	**History**	:	Monsoon 2019
24	**Geomorphology**	:	Lowly dissected
25	**Geology/ Lithology**	:	Laterite, soil covered
26	**Structure**	:	Nil
27	**Land use/ Land Cover**	:	Cultivation
28	**Hydrological condition**	:	Flowing
29	**Triggering factor**	:	Rainfall
30	**Death of persons**	:	Nil
31	**People affected**	:	Nil
32	**Livestock loss**	:	Nil
33	**Communication**	:	Nil

34	**Infrastructure**	:	Nil
35	**Agriculture/ Forest/ Barren**	:	Agriculture
36	**Geo-scientific causes**	:	Toe erosion by stream
37	**Remedial measures**	:	Toe support by appropriate measure
38	**Remarks, if any**	:	Nil
39	**Photo**	:	
40	**Summary/ Abstract**	:	The banks of the stream have been eroded during the heavy rainfall, where the stream discharge increased.
41	**Date of Reporting**	:	27.12.2019
42	**Landslide Category**	:	2

	Field	:	Description
	Location No	:	329
1	**Slide No**	:	49
2	**State**	:	Karnataka
3	**District**	:	Uttara Kannada
4	**Toposheet**	:	48J/13
5	**Name of Slide**	:	KAR/UK/48J13/2019/49
6	**NH/SH/Locality**	:	Bidralli
7	**Latitude**	:	14° 49' 16.247" N
8	**Longitude**	:	74° 48' 51.233" E
9	**Length**	:	15m
10	**Width**	:	50m
11	**Height**	:	10m
12	**Area**	:	750 sq.m
13	**Depth**	:	1m
14	**Volume**	:	750 cu.m
15	**Run out Distance**	:	5m
16	**Type of Material**	:	Debris
17	**Type of Movement**	:	Slide
18	**Rate of movement**	:	Moderate
19	**Activity**	:	Suspended
20	**Distribution**	:	Advancing, Widening
21	**Style**	:	Multiple
22	**Failure Mechanism**	:	Shallow Planar Failure
23	**History**	:	Aug-Sept 2019
24	**Geomorphology**	:	Lowly dissected
25	**Geology/ Lithology**	:	Meta argillite, Laterite
26	**Structure**	:	Nil
27	**Land use/ Land Cover**	:	Cultivation, Moderate vegetation
28	**Hydrological condition**	:	Dry
29	**Triggering factor**	:	Rainfall
30	**Death of persons**	:	Nil
31	**People affected**	:	Nil
32	**Livestock loss**	:	Nil
33	**Communication**	:	Nil

34	**Infrastructure**	:	Nil
35	**Agriculture/ Forest/ Barren**	:	Agriculture/ Forest
36	**Geo-scientific causes**	:	Toe erosion by stream
37	**Remedial measures**	:	Toe support by appropriate measures. Avoid removal of material from the base of the slope
38	**Remarks, if any**	:	Nil
39	**Photo**	:	
40	**Summary/ Abstract**	:	The landslide has occurred by erosion of the toe of the slope by the stream flowing at the base. During rainfall, the water flow tends to become turbulent causing the river to erode its banks. Along with the weathered material, vegetation and rock fragments have also slided along the slope.
41	**Date of Reporting**	:	30.12.2019
42	**Landslide Category**	:	3

	Field	:	Description
	Location No	:	341
1	**Slide No**	:	50
2	**State**	:	Karnataka
3	**District**	:	Uttara Kannada
4	**Toposheet**	:	48J/14
5	**Name of Slide**	:	KAR/UK/48J14/2019/50
6	**NH/SH/Locality**	:	Kerekoppa, Agsale village
7	**Latitude**	:	14° 42' 16.524" N
8	**Longitude**	:	74° 48' 49.221" E
9	**Length**	:	25m
10	**Width**	:	20m
11	**Height**	:	18m
12	**Area**	:	500 sq.m
13	**Depth**	:	2m
14	**Volume**	:	1000 cu.m
15	**Run out Distance**	:	6m
16	**Type of Material**	:	Rock cum debris
17	**Type of Movement**	:	Slide
18	**Rate of movement**	:	Moderate
19	**Activity**	:	Suspended
20	**Distribution**	:	Widening
21	**Style**	:	Single
22	**Failure Mechanism**	:	Shallow Planar Failure
23	**History**	:	Sept- Oct 2019
24	**Geomorphology**	:	Moderately dissected
25	**Geology/ Lithology**	:	Meta argillite, Laterite
26	**Structure**	:	Nil
27	**Land use/ Land Cover**	:	Moderate vegetation
28	**Hydrological condition**	:	Wet
29	**Triggering factor**	:	Rainfall
30	**Death of persons**	:	Nil
31	**People affected**	:	River blocked causing water to overflow into fields
32	**Livestock loss**	:	Nil
33	**Communication**	:	Nil

34	**Infrastructure**	:	Nil
35	**Agriculture/ Forest/ Barren**	:	Forest
36	**Geo-scientific causes**	:	Toe erosion by stream. Loading on head region
37	**Remedial measures**	:	Toe support by appropriate measures. Avoid removal of material from the base of the slope
38	**Remarks, if any**	:	Overburden is very high. Slope gradient also high, with thick vegetation on the slope
39	**Photo**	:	
40	**Summary/ Abstract**	:	The landslide has occurred by erosion of the toe of the slope by the stream flowing at the base. During rainfall, the water flow tends to become turbulent causing the river to erode its banks. Along with the weathered material, vegetation and rock fragments have also slided along the slope.
41	**Date of Reporting**	:	03.01.2020
42	**Landslide Category**	:	3

	Field	:	Description
	Location No	:	343
1	**Slide No**	:	51
2	**State**	:	Karnataka
3	**District**	:	Uttara Kannada
4	**Toposheet**	:	48J/14
5	**Name of Slide**	:	KAR/UK/48J14/2019/51
6	**NH/SH/Locality**	:	Gaddigehole-Agsale village
7	**Latitude**	:	14° 41' 22.322" N
8	**Longitude**	:	74° 48' 57.184" E
9	**Length**	:	35m
10	**Width**	:	100m
11	**Height**	:	30m
12	**Area**	:	3500 sq.m
13	**Depth**	:	3m
14	**Volume**	:	10500
15	**Run out Distance**	:	2m
16	**Type of Material**	:	Debris
17	**Type of Movement**	:	Slide
18	**Rate of movement**	:	Moderate
19	**Activity**	:	Suspended
20	**Distribution**	:	Advancing, Widening
21	**Style**	:	Multiple
22	**Failure Mechanism**	:	Deep Planar Failure
23	**History**	:	Sept-Oct 2019
24	**Geomorphology**	:	Moderately dissected
25	**Geology/ Lithology**	:	Meta argillite
26	**Structure**	:	Nil
27	**Land use/ Land Cover**	:	Moderate vegetation
28	**Hydrological condition**	:	Wet
29	**Triggering factor**	:	Rainfall
30	**Death of persons**	:	Nil
31	**People affected**	:	Stream blocked
32	**Livestock loss**	:	Nil
33	**Communication**	:	Nil

34	**Infrastructure**	:	Nil
35	**Agriculture/ Forest/ Barren**	:	Agriculture/ Forest
36	**Geo-scientific causes**	:	Toe erosion by stream
37	**Remedial measures**	:	Toe support by appropriate measures. Avoid removal of material from the base of the slope. Benching of slope
38	**Remarks, if any**	:	Argillite is highly jointed and overburden is thick
39	**Photo**	:	
40	**Summary/ Abstract**	:	The slope gradient is high. Moreover its continuously failing during the rains. After the slide the stream was blocked. At places the stream is almost 5 feet deep. The owners tend to remove the failed material at the base of the slope for cultivation purposes. This further intensifies sliding during the next monsoons.
41	**Date of Reporting**	:	03.01.2020
42	**Landslide Category**	:	3

	Field	:	Description
	Location No	:	347
1	**Slide No**	:	52
2	**State**	:	Karnataka
3	**District**	:	Uttara Kannada
4	**Toposheet**	:	48I/12
5	**Name of Slide**	:	KAR/UK/48I12/2019/52
6	**NH/SH/Locality**	:	Ambikanagara (road to PH)
7	**Latitude**	:	15° 6' 18.220" N
8	**Longitude**	:	74° 38' 45.059" E
9	**Length**	:	30m
10	**Width**	:	50m
11	**Height**	:	20m
12	**Area**	:	1500 sq.m
13	**Depth**	:	1m
14	**Volume**	:	1500 cu.m
15	**Run out Distance**	:	15m
16	**Type of Material**	:	Debris
17	**Type of Movement**	:	Flow
18	**Rate of movement**	:	Very rapid
19	**Activity**	:	Suspended
20	**Distribution**	:	Advancing
21	**Style**	:	Multiple
22	**Failure Mechanism**	:	Shallow Planar Failure
23	**History**	:	Monsoon 2019
24	**Geomorphology**	:	Moderately dissected
25	**Geology/ Lithology**	:	Meta argillite
26	**Structure**	:	jointed
27	**Land use/ Land Cover**	:	Moderate vegetation
28	**Hydrological condition**	:	Dry
29	**Triggering factor**	:	Rainfall
30	**Death of persons**	:	Nil
31	**People affected**	:	Nil
32	**Livestock loss**	:	Nil
33	**Communication**	:	Road
34	**Infrastructure**	:	Nil
35	**Agriculture/ Forest/ Barren**	:	Forest

36	**Geo-scientific causes**	:	Unplanned cutting of slope
37	**Remedial measures**	:	Minimizing the slope. Give toe support at the zone of accumulation along with plantation along the slope
38	**Remarks, if any**	:	Nil
39	**Photo**	:	
40	**Summary/ Abstract**	:	Thick overburden and head load has caused the slope to fail. Moreover unscientific road cuts have also aided to failure of the slope during rainy season.
41	**Date of Reporting**	:	15.01.2020
42	**Landslide Category**	:	2

	Field	:	Description
	Location No	:	348
1	**Slide No**	:	53
2	**State**	:	Karnataka
3	**District**	:	Uttara Kannada
4	**Toposheet**	:	48I/12
5	**Name of Slide**	:	KAR/UK/48I12/2019/53
6	**NH/SH/Locality**	:	Ambikanagara (road to PH)
7	**Latitude**	:	15° 6' 11.050" N
8	**Longitude**	:	74° 38' 45.445" E
9	**Length**	:	50m
10	**Width**	:	50m
11	**Height**	:	20m
12	**Area**	:	2500 sq.m
13	**Depth**	:	1m
14	**Volume**	:	2500
15	**Run out Distance**	:	5m
16	**Type of Material**	:	Debris
17	**Type of Movement**	:	Flow
18	**Rate of movement**	:	Very rapid
19	**Activity**	:	Suspended
20	**Distribution**	:	Advancing
21	**Style**	:	Multiple
22	**Failure Mechanism**	:	Shallow Planar Failure
23	**History**	:	Monsoon 2019
24	**Geomorphology**	:	Moderately dissected
25	**Geology/ Lithology**	:	Meta argillite
26	**Structure**	:	jointed
27	**Land use/ Land Cover**	:	Moderate vegetation
28	**Hydrological condition**	:	Dry
29	**Triggering factor**	:	Rainfall
30	**Death of persons**	:	Nil
31	**People affected**	:	Nil
32	**Livestock loss**	:	Nil
33	**Communication**	:	Road

34	**Infrastructure**	:	Nil
35	**Agriculture/ Forest/ Barren**	:	Forest
36	**Geo-scientific causes**	:	Unplanned cutting of slope
37	**Remedial measures**	:	Minimizing the slope. Give toe support at the zone of accumulation along with plantation along the slope
38	**Remarks, if any**	:	Nil
39	**Photo**	:	
40	**Summary/ Abstract**	:	Thick overburden and head load has caused the slope to fail. Moreover unscientific road cuts have also aided to failure of the slope during rainy season.
41	**Date of Reporting**	:	15.01.2021
42	**Landslide Category**	:	2

	Field	:	Description
	Location No	:	349
1	**Slide No**	:	54
2	**State**	:	Karnataka
3	**District**	:	Uttara Kannada
4	**Toposheet**	:	48I/12
5	**Name of Slide**	:	KAR/UK/48I12/2019/54
6	**NH/SH/Locality**	:	Ambikanagara (road to PH)
7	**Latitude**	:	15° 6' 6.920" N
8	**Longitude**	:	74° 38' 46.351" E
9	**Length**	:	12m
10	**Width**	:	50m
11	**Height**	:	10m
12	**Area**	:	600 sq.m
13	**Depth**	:	1.5m
14	**Volume**	:	900 cu.m
15	**Run out Distance**	:	1m
16	**Type of Material**	:	Debris
17	**Type of Movement**	:	Flow
18	**Rate of movement**	:	Very rapid
19	**Activity**	:	Suspended
20	**Distribution**	:	Advancing
21	**Style**	:	Single
22	**Failure Mechanism**	:	Shallow Planar Failure
23	**History**	:	Monsoon 2019
24	**Geomorphology**	:	Moderately dissected
25	**Geology/ Lithology**	:	Meta argillite
26	**Structure**	:	jointed
27	**Land use/ Land Cover**	:	Moderate vegetation
28	**Hydrological condition**	:	Dry
29	**Triggering factor**	:	Rainfall
30	**Death of persons**	:	Nil
31	**People affected**	:	Nil
32	**Livestock loss**	:	Nil
33	**Communication**	:	Road
34	**Infrastructure**	:	Nil
35	**Agriculture/ Forest/ Barren**	:	Forest
36	**Geo-scientific causes**	:	Unplanned cutting of slope. Loading at head

37	**Remedial measures**	:	Minimising the slope. Give toe support at the zone of accumalation. Give proper drainage management
38	**Remarks, if any**	:	Nil
39	**Photo**	:	
40	**Summary/ Abstract**	:	Thick overburden and head load has caused the slope to fail. Moreover unscientific road cuts have also aided to failure of the slope during rainy season.
41	**Date of Reporting**	:	15.01.2020
42	**Landslide Category**	:	2

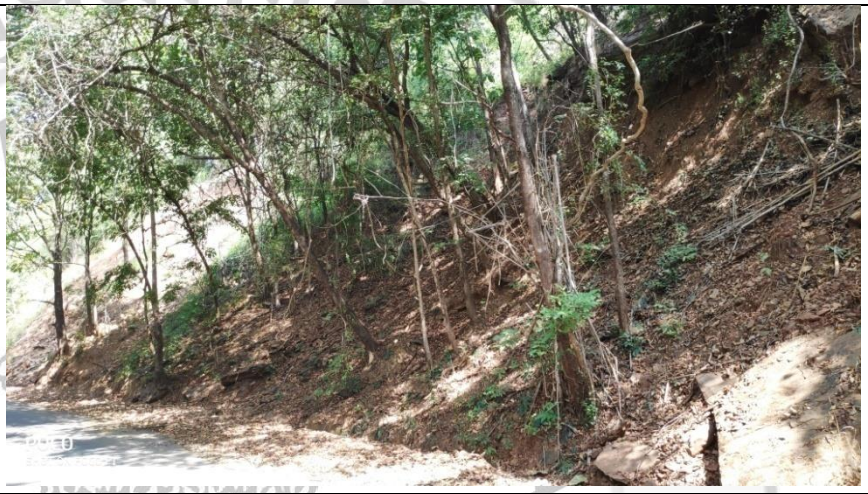
	Field	:	Description
	Location No	:	350
1	**Slide No**	:	55
2	**State**	:	Karnataka
3	**District**	:	Uttara Kannada
4	**Toposheet**	:	48I/12
5	**Name of Slide**	:	KAR/UK/48I12/2019/55
6	**NH/SH/Locality**	:	Ambikanagara (road to PH)
7	**Latitude**	:	15° 6' 4.515" N
8	**Longitude**	:	74° 38' 45.579" E
9	**Length**	:	18m
10	**Width**	:	20m
11	**Height**	:	15m
12	**Area**	:	360 sq.m
13	**Depth**	:	1m
14	**Volume**	:	360 cu.m
15	**Run out Distance**	:	1m
16	**Type of Material**	:	Debris
17	**Type of Movement**	:	Flow
18	**Rate of movement**	:	Very rapid
19	**Activity**	:	Suspended
20	**Distribution**	:	Advancing
21	**Style**	:	Single
22	**Failure Mechanism**	:	Shallow Planar Failure
23	**History**	:	Monsoon 2019
24	**Geomorphology**	:	Moderately dissected
25	**Geology/ Lithology**	:	Meta Phyllite
26	**Structure**	:	jointed
27	**Land use/ Land Cover**	:	Moderate vegetation
28	**Hydrological condition**	:	Dry
29	**Triggering factor**	:	Rainfall
30	**Death of persons**	:	Nil
31	**People affected**	:	Nil
32	**Livestock loss**	:	Nil
33	**Communication**	:	Road
34	**Infrastructure**	:	Nil
35	**Agriculture/ Forest/ Barren**	:	Forest
36	**Geo-scientific causes**	:	Unplanned cutting of slope. Loading at head

37	**Remedial measures**	:	Minimizing the slope. Give toe support at the zone of accumulation. Give proper drainage management
38	**Remarks, if any**	:	Nil
39	**Photo**	:	
40	**Summary/ Abstract**	:	Thick overburden and head load has caused the slope to fail. Moreover unscientific road cuts have also aided to failure of the slope during rainy season.
41	**Date of Reporting**	:	15.01.2020
42	**Landslide Category**	:	2

	Field	:	Description
	Location No	:	351
1	**Slide No**	:	56
2	**State**	:	Karnataka
3	**District**	:	Uttara Kannada
4	**Toposheet**	:	48I/12
5	**Name of Slide**	:	KAR/UK/48I12/2019/56
6	**NH/SH/Locality**	:	Ambikanagara (road to PH)
7	**Latitude**	:	15° 5' 35.410" N
8	**Longitude**	:	74° 38' 40.805" E
9	**Length**	:	50m
10	**Width**	:	50m
11	**Height**	:	10m
12	**Area**	:	2500 sq.m
13	**Depth**	:	1m
14	**Volume**	:	2500 cu.m
15	**Run out Distance**	:	10m
16	**Type of Material**	:	Debris
17	**Type of Movement**	:	Flow
18	**Rate of movement**	:	Very rapid
19	**Activity**	:	Suspended
20	**Distribution**	:	Advancing, Widening
21	**Style**	:	Multiple
22	**Failure Mechanism**	:	Shallow Planar Failure
23	**History**	:	Monsoon 2019
24	**Geomorphology**	:	Moderately dissected
25	**Geology/ Lithology**	:	Meta argillite
26	**Structure**	:	jointed
27	**Land use/ Land Cover**	:	Dense vegetation
28	**Hydrological condition**	:	Dry
29	**Triggering factor**	:	Rainfall
30	**Death of persons**	:	Nil
31	**People affected**	:	Nil
32	**Livestock loss**	:	Nil
33	**Communication**	:	Nil
34	**Infrastructure**	:	Road
35	**Agriculture/ Forest/ Barren**	:	Forest
36	**Geo-scientific causes**	:	Unplanned construction, Loading at head region. Increase in unit mass
37	**Remedial measures**	:	Provide appropriate to support. Minimizing of slope

38	**Remarks, if any**	:	Nil
39	**Photo**	:	
40	**Summary/ Abstract**	:	Thick overburden and head load has caused the slope to fail. Moreover unscientific road cuts have also aided to failure of the slope during rainy season.
41	**Date of Reporting**	:	15.01.2020
42	**Landslide Category**	:	2

	Field	:	Description
	Location No	:	352
1	**Slide No**	:	57
2	**State**	:	Karnataka
3	**District**	:	Uttara Kannada
4	**Toposheet**	:	48I/12
5	**Name of Slide**	:	KAR/UK/48I12/2019/57
6	**NH/SH/Locality**	:	Ambikanagara (road to PH)
7	**Latitude**	:	15° 5' 11.062" N
8	**Longitude**	:	74° 38' 41.424" E
9	**Length**	:	50m
10	**Width**	:	200m
11	**Height**	:	30m
12	**Area**	:	10000 sq.m
13	**Depth**	:	1m
14	**Volume**	:	10000
15	**Run out Distance**	:	10m
16	**Type of Material**	:	Debris
17	**Type of Movement**	:	Flow
18	**Rate of movement**	:	Very rapid
19	**Activity**	:	Suspended
20	**Distribution**	:	Advancing, Widening
21	**Style**	:	Single
22	**Failure Mechanism**	:	Shallow Planar Failure
23	**History**	:	Monsoon 2019
24	**Geomorphology**	:	Moderately dissected
25	**Geology/ Lithology**	:	Meta argillite
26	**Structure**	:	jointed
27	**Land use/ Land Cover**	:	Dense vegetation
28	**Hydrological condition**	:	Dry
29	**Triggering factor**	:	Rainfall
30	**Death of persons**	:	Nil
31	**People affected**	:	Nil
32	**Livestock loss**	:	Nil
33	**Communication**	:	Road

34	**Infrastructure**	:	Nil
35	**Agriculture/ Forest/ Barren**	:	Forest
36	**Geo-scientific causes**	:	Unplanned construction, Loading at head region. Increase in unit mass
37	**Remedial measures**	:	Appropriate retaining support at toe part. Give flying support on rock partition to distribute forces.
38	**Remarks, if any**	:	Nil
39	**Photo**	:	
40	**Summary/ Abstract**	:	Thick overburden and head load has caused the slope to fail. Moreover unscientific road cuts have also aided to failure of the slope during rainy season.
41	**Date of Reporting**	:	15.01.2020
42	**Landslide Category**	:	2

	Field	:	Description
	Location No	:	353
1	**Slide No**	:	58
2	**State**	:	Karnataka
3	**District**	:	Uttara Kannada
4	**Toposheet**	:	48I/12
5	**Name of Slide**	:	KAR/UK/48I12/2019/58
6	**NH/SH/Locality**	:	Ambikanagara (road to PH)
7	**Latitude**	:	15° 5' 59.252" N
8	**Longitude**	:	74° 38' 41.991" E
9	**Length**	:	20m
10	**Width**	:	10m
11	**Height**	:	18m
12	**Area**	:	200 sq.m
13	**Depth**	:	5m
14	**Volume**	:	10000
15	**Run out Distance**	:	1m
16	**Type of Material**	:	Debris
17	**Type of Movement**	:	Slide
18	**Rate of movement**	:	Moderate
19	**Activity**	:	Suspended
20	**Distribution**	:	Confined
21	**Style**	:	Single
22	**Failure Mechanism**	:	Deep Planar Failure
23	**History**	:	Old slide
24	**Geomorphology**	:	Moderately dissected
25	**Geology/ Lithology**	:	Meta Phyllite
26	**Structure**	:	jointed
27	**Land use/ Land Cover**	:	Dense vegetation
28	**Hydrological condition**	:	Dry
29	**Triggering factor**	:	Rainfall
30	**Death of persons**	:	Nil
31	**People affected**	:	Nil
32	**Livestock loss**	:	Nil
33	**Communication**	:	Road

34	**Infrastructure**	:	Nil
35	**Agriculture/ Forest/ Barren**	:	Forest
36	**Geo-scientific causes**	:	Pore water pressure. Reduction of strength on super saturation
37	**Remedial measures**	:	Maintain proper water passage from slope. Insert perforated contour drain pipes for drainage
38	**Remarks, if any**	:	Nil
39	**Photo**	:	
40	**Summary/ Abstract**	:	The landslide is a debris slide, where the material has flowed over the retaining wall. Increase in pore water pressure has caused to material to almost flow instead of slide.
41	**Date of Reporting**	:	15.01.2020
42	**Landslide Category**	:	2

	Field	:	Description
	Location No	:	361
1	**Slide No**	:	59
2	**State**	:	Karnataka
3	**District**	:	Uttara Kannada
4	**Toposheet**	:	48I/12
5	**Name of Slide**	:	KAR/UK/48I12/2019/59
6	**NH/SH/Locality**	:	KPCL Ghat Road, Ambikanagar
7	**Latitude**	:	15° 6' 31.518" N
8	**Longitude**	:	74° 38' 48.590" E
9	**Length**	:	18m
10	**Width**	:	30m
11	**Height**	:	15m
12	**Area**	:	540 sq.m
13	**Depth**	:	1m
14	**Volume**	:	540 cu.m
15	**Run out Distance**	:	2m
16	**Type of Material**	:	Rcok cum debris
17	**Type of Movement**	:	Slide
18	**Rate of movement**	:	Rapid
19	**Activity**	:	Suspended
20	**Distribution**	:	Confined
21	**Style**	:	Single
22	**Failure Mechanism**	:	Shallow Planar Failure
23	**History**	:	Aug-19
24	**Geomorphology**	:	Moderately dissected
25	**Geology/ Lithology**	:	Soil covered
26	**Structure**	:	Nil
27	**Land use/ Land Cover**	:	Dense vegetation
28	**Hydrological condition**	:	Dry
29	**Triggering factor**	:	Rainfall
30	**Death of persons**	:	Nil
31	**People affected**	:	Nil
32	**Livestock loss**	:	Nil
33	**Communication**	:	Road
34	**Infrastructure**	:	Nil

35	**Agriculture/ Forest/ Barren**	:	Forest
36	**Geo-scientific causes**	:	Unplanned cutting of slope
37	**Remedial measures**	:	Slope to be benched. Retaining wall may be given along with plantation on the slope
38	**Remarks, if any**	:	Nil
39	**Photo**	:	
40	**Summary/ Abstract**	:	Thick overburden and head load has caused the slope to fail. Moreover unscientific road cuts have also aided to failure of the slope during rainy season.
41	**Date of Reporting**	:	16.01.2020
42	**Landslide Category**	:	2

	Field	:	Description
	Location No	:	363
1	**Slide No**	:	60
2	**State**	:	Karnataka
3	**District**	:	Uttara Kannada
4	**Toposheet**	:	48I/12
5	**Name of Slide**	:	KAR/UK/48I12/2019/60
6	**NH/SH/Locality**	:	KPCL Ghat Road, Ambikanagar
7	**Latitude**	:	15° 5' 49.403" N
8	**Longitude**	:	74° 38' 47.172" E
9	**Length**	:	18m
10	**Width**	:	25m
11	**Height**	:	17m
12	**Area**	:	450 sq.m
13	**Depth**	:	1m
14	**Volume**	:	450 cu.m
15	**Run out Distance**	:	2m
16	**Type of Material**	:	Debris
17	**Type of Movement**	:	Slide
18	**Rate of movement**	:	Moderate
19	**Activity**	:	Suspended
20	**Distribution**	:	Enlarging
21	**Style**	:	Multiple
22	**Failure Mechanism**	:	Shallow Planar Failure
23	**History**	:	Old slide
24	**Geomorphology**	:	Escarpment
25	**Geology/ Lithology**	:	Meta Argillite
26	**Structure**	:	jointed
27	**Land use/ Land Cover**	:	Dense vegetation
28	**Hydrological condition**	:	Dry
29	**Triggering factor**	:	Rainfall
30	**Death of persons**	:	Nil
31	**People affected**	:	Nil
32	**Livestock loss**	:	Nil
33	**Communication**	:	Road

34	**Infrastructure**	:	Nil
35	**Agriculture/ Forest/ Barren**	:	Forest
36	**Geo-scientific causes**	:	Loading at head region
37	**Remedial measures**	:	Appropriate toe support to retain slided material. Proper drainage network may be provided along with plantation along the slope.
38	**Remarks, if any**	:	Nil
39	**Photo**	:	
40	**Summary/ Abstract**	:	The thick vegetation upslope has led to failure of slope. This accompanied by unplanned cutting of slope has caused failure.
41	**Date of Reporting**	:	16.01.2020
42	**Landslide Category**	:	2

	Field	:	Description
	Location No	:	364
1	**Slide No**	:	61
2	**State**	:	Karnataka
3	**District**	:	Uttara Kannada
4	**Toposheet**	:	48I/12
5	**Name of Slide**	:	KAR/UK/48I12/2019/61
6	**NH/SH/Locality**	:	KPCL Ghat Road, Ambikanagar
7	**Latitude**	:	15° 5' 30.054" N
8	**Longitude**	:	74° 38' 40.287" E
9	**Length**	:	22m
10	**Width**	:	25m
11	**Height**	:	20m
12	**Area**	:	550 sq.m
13	**Depth**	:	1m
14	**Volume**	:	550 cu.m
15	**Run out Distance**	:	3m
16	**Type of Material**	:	Debris
17	**Type of Movement**	:	Slide
18	**Rate of movement**	:	Rapid
19	**Activity**	:	Suspended
20	**Distribution**	:	Widening
21	**Style**	:	Multiple
22	**Failure Mechanism**	:	Shallow Planar Failure
23	**History**	:	Old slide
24	**Geomorphology**	:	Escarpment
25	**Geology/ Lithology**	:	Meta Argillite
26	**Structure**	:	Jointed
27	**Land use/ Land Cover**	:	Dense vegetation
28	**Hydrological condition**	:	Dry
29	**Triggering factor**	:	Rainfall
30	**Death of persons**	:	Nil
31	**People affected**	:	Nil
32	**Livestock loss**	:	Nil
33	**Communication**	:	Road

34	**Infrastructure**	:	Nil
35	**Agriculture/ Forest/ Barren**	:	Forest
36	**Geo-scientific causes**	:	Loading at head region
37	**Remedial measures**	:	Appropriate toe support to retain slide material. Proper drainage network along with plantation on the slope.
38	**Remarks, if any**	:	Nil
39	**Photo**	:	
40	**Summary/ Abstract**	:	The thick vegetation upslope has led to failure of slope. This accompanied by unplanned cutting of slope has caused failure.
41	**Date of Reporting**	:	16.01.2020
42	**Landslide Category**	:	2

	Field	:	Description
	Location No	:	365
1	**Slide No**	:	62
2	**State**	:	Karnataka
3	**District**	:	Uttara Kannada
4	**Toposheet**	:	48I/12
5	**Name of Slide**	:	KAR/UK/48I12/2019/62
6	**NH/SH/Locality**	:	KPCL Ghat Road, Ambikanagar
7	**Latitude**	:	15° 5' 26.791" N
8	**Longitude**	:	74° 38' 40.293" E
9	**Length**	:	18m
10	**Width**	:	20m
11	**Height**	:	15m
12	**Area**	:	360 sq.m
13	**Depth**	:	1m
14	**Volume**	:	360 cu.m
15	**Run out Distance**	:	3m
16	**Type of Material**	:	Debris
17	**Type of Movement**	:	Slide
18	**Rate of movement**	:	Rapid
19	**Activity**	:	Suspended
20	**Distribution**	:	Enlarging
21	**Style**	:	Multiple
22	**Failure Mechanism**	:	Shallow Planar Failure
23	**History**	:	Old slide
24	**Geomorphology**	:	Escarpment
25	**Geology/ Lithology**	:	Meta Argillite
26	**Structure**	:	Jointed
27	**Land use/ Land Cover**	:	Dense vegetation
28	**Hydrological condition**	:	Dry
29	**Triggering factor**	:	Rainfall
30	**Death of persons**	:	Nil
31	**People affected**	:	Nil
32	**Livestock loss**	:	Nil
33	**Communication**	:	Road

34	**Infrastructure**	:	Nil
35	**Agriculture/ Forest/ Barren**	:	Forest
36	**Geo-scientific causes**	:	Loading at head region
37	**Remedial measures**	:	Appropriate toe support to retain slide material. Proper drainage network along with plantation on the slope
38	**Remarks, if any**	:	Nil
39	**Photo**	:	
40	**Summary/ Abstract**	:	The thick vegetation upslope has led to failure of slope. This accompanied by unplanned cutting of slope has caused failure.
41	**Date of Reporting**	:	16.01.2020
42	**Landslide Category**	:	2

	Field	:	Description
	Location No	:	379
1	**Slide No**	:	63
2	**State**	:	Karnataka
3	**District**	:	Uttara Kannada
4	**Toposheet**	:	48I/12
5	**Name of Slide**	:	KAR/UK/48I12/2019/63
6	**NH/SH/Locality**	:	Near Kaneri village
7	**Latitude**	:	15° 5' 8.918" N
8	**Longitude**	:	74° 31' 2.277" E
9	**Length**	:	15m
10	**Width**	:	20m
11	**Height**	:	12m
12	**Area**	:	300 sq.m
13	**Depth**	:	1.5m
14	**Volume**	:	450 cu.m
15	**Run out Distance**	:	2m
16	**Type of Material**	:	Debris
17	**Type of Movement**	:	Slide
18	**Rate of movement**	:	
19	**Activity**	:	Suspended
20	**Distribution**	:	Confined
21	**Style**	:	Single
22	**Failure Mechanism**	:	Shallow Planar Failure
23	**History**	:	Monsoon 2019
24	**Geomorphology**	:	Moderately dissected
25	**Geology/ Lithology**	:	Soil covered
26	**Structure**	:	Nil
27	**Land use/ Land Cover**	:	Dense Vegetation
28	**Hydrological condition**	:	Dry
29	**Triggering factor**	:	Rainfall
30	**Death of persons**	:	Nil
31	**People affected**	:	Nil
32	**Livestock loss**	:	Nil
33	**Communication**	:	Nil
34	**Infrastructure**	:	Nil
35	**Agriculture/ Forest/ Barren**	:	Forest
36	**Geo-scientific causes**	:	Unplanned cutting of slope
37	**Remedial measures**	:	Slope to be benched along with plantation on the slope

38	**Remarks, if any**	:	Nil
39	**Photo**	:	
40	**Summary/ Abstract**	:	The slope failure occurred due to unscientific cutting of slope for construction of roads. The slope gradient is very high and there is thick vegetation on the upper slopes, making it susceptible to failure.
41	**Date of Reporting**	:	17.01.2020
42	**Landslide Category**	:	3

	Field	:	Description
	Location No	:	383
1	**Slide No**	:	64
2	**State**	:	Karnataka
3	**District**	:	Uttara Kannada
4	**Toposheet**	:	48I/12
5	**Name of Slide**	:	KAR/UK/48I12/2019/64
6	**NH/SH/Locality**	:	Nandigade village
7	**Latitude**	:	15° 3' 50.084" N
8	**Longitude**	:	74° 33' 11.090" E
9	**Length**	:	10m
10	**Width**	:	12m
11	**Height**	:	8m
12	**Area**	:	120 sq.m
13	**Depth**	:	1m
14	**Volume**	:	120 cu.m
15	**Run out Distance**	:	2m
16	**Type of Material**	:	Soil
17	**Type of Movement**	:	Slide
18	**Rate of movement**	:	Moderate
19	**Activity**	:	Suspended
20	**Distribution**	:	Confined
21	**Style**	:	Single
22	**Failure Mechanism**	:	Shallow Planar Failure
23	**History**	:	Monsoon 2019
24	**Geomorphology**	:	Moderately dissected
25	**Geology/ Lithology**	:	Soil covered
26	**Structure**	:	Nil
27	**Land use/ Land Cover**	:	Dense Vegetation
28	**Hydrological condition**	:	Dry
29	**Triggering factor**	:	Rainfall
30	**Death of persons**	:	Nil
31	**People affected**	:	Nil
32	**Livestock loss**	:	Nil
33	**Communication**	:	Nil

34	**Infrastructure**	:	Nil
35	**Agriculture/ Forest/ Barren**	:	Forest
36	**Geo-scientific causes**	:	Unplanned cutting of slope. Toe erosion by stream
37	**Remedial measures**	:	Slope to be modified. Proper drainage to be given along with plantation on the slope.
38	**Remarks, if any**	:	Nil
39	**Photo**	:	
40	**Summary/ Abstract**	:	The slope failure occurred due to unscientific cutting of slope for construction of roads. The slope gradient is very high and there is thick vegetation on the upper slopes, making it susceptible to failure.
41	**Date of Reporting**	:	17.01.2020
42	**Landslide Category**	:	3

	Field	:	Description
	Location No	:	388
1	**Slide No**	:	65
2	**State**	:	Karnataka
3	**District**	:	Uttara Kannada
4	**Toposheet**	:	48I/12
5	**Name of Slide**	:	KAR/UK/48I12/2019/65
6	**NH/SH/Locality**	:	Shivalli village
7	**Latitude**	:	15° 1' 59.518" N
8	**Longitude**	:	74° 33' 45.208" E
9	**Length**	:	10m
10	**Width**	:	50m
11	**Height**	:	2m
12	**Area**	:	500 sq.m
13	**Depth**	:	5m
14	**Volume**	:	2500
15	**Run out Distance**	:	7m
16	**Type of Material**	:	Soil
17	**Type of Movement**	:	Creep
18	**Rate of movement**	:	Very low
19	**Activity**	:	Suspended
20	**Distribution**	:	Enlarging
21	**Style**	:	Complex
22	**Failure Mechanism**	:	Deep Planar Failure
23	**History**	:	Monsoon 2019
24	**Geomorphology**	:	Lowly Dissected
25	**Geology/ Lithology**	:	Soil covered
26	**Structure**	:	Nil
27	**Land use/ Land Cover**	:	Cultivation
28	**Hydrological condition**	:	Dry
29	**Triggering factor**	:	Rainfall
30	**Death of persons**	:	Nil
31	**People affected**	:	Nil
32	**Livestock loss**	:	Nil

33	**Communication**	:	Nil
34	**Infrastructure**	:	Nil
35	**Agriculture/ Forest/ Barren**	:	Agriculture
36	**Geo-scientific causes**	:	Reduction of strength on super saturation
37	**Remedial measures**	:	Perforated pipes to drain out water. Provide proper drainage management
38	**Remarks, if any**	:	Nil
39	**Photo**	:	
40	**Summary/ Abstract**	:	Increased rainfall in the area and modifications of land for cultivation, accompanied by blocking of streams has led to subsidence in the area. Cracks have developed parallel to the crown all along the area, and these cracks are filled with water during the rains.
41	**Date of Reporting**	:	17.01.2020
42	**Landslide Category**	:	1

	Field	:	Description
	Location No	:	389
1	**Slide No**	:	66
2	**State**	:	Karnataka
3	**District**	:	Uttara Kannada
4	**Toposheet**	:	48I/12
5	**Name of Slide**	:	KAR/UK/48I12/2019/66
6	**NH/SH/Locality**	:	Karkamane village
7	**Latitude**	:	15° 2' 20.312" N
8	**Longitude**	:	74° 33' 9.315" E
9	**Length**	:	10m
10	**Width**	:	25m
11	**Height**	:	8m
12	**Area**	:	250Sq.m
13	**Depth**	:	1m
14	**Volume**	:	250 cu.m
15	**Run out Distance**	:	2m
16	**Type of Material**	:	Soil
17	**Type of Movement**	:	Slide
18	**Rate of movement**	:	Rapid
19	**Activity**	:	Suspended
20	**Distribution**	:	Confined
21	**Style**	:	Single
22	**Failure Mechanism**	:	Shallow Planar Failure
23	**History**	:	Monsoon 2019
24	**Geomorphology**	:	Moderately dissected
25	**Geology/ Lithology**	:	Soil covered
26	**Structure**	:	Nil
27	**Land use/ Land Cover**	:	Dense Vegetation
28	**Hydrological condition**	:	Dry
29	**Triggering factor**	:	Rainfall
30	**Death of persons**	:	Nil
31	**People affected**	:	Nil
32	**Livestock loss**	:	Nil

33	**Communication**	:	Nil
34	**Infrastructure**	:	Nil
35	**Agriculture/ Forest/ Barren**	:	Forest
36	**Geo-scientific causes**	:	Unplanned cutting of slope
37	**Remedial measures**	:	Benching of slope. Reduce the gradient of slope along with plantation on the slope
38	**Remarks, if any**	:	
39	**Photo**	:	
40	**Summary/ Abstract**	:	The slope failure occurred due to unscientific cutting of slope for construction of roads. The slope gradient is very high and there is thick vegetation on the upper slopes, making it susceptible to failure.
41	**Date of Reporting**	:	17.01.2020
42	**Landslide Category**	:	3

	Field	:	Description
	Location No	:	395
1	**Slide No**	:	67
2	**State**	:	Karnataka
3	**District**	:	Uttara Kannada
4	**Toposheet**	:	48I/12
5	**Name of Slide**	:	KAR/UK/48I12/2019/67
6	**NH/SH/Locality**	:	Potoli village
7	**Latitude**	:	15° 11' 13.471" N
8	**Longitude**	:	74° 33' 13.497" E
9	**Length**	:	12m
10	**Width**	:	30m
11	**Height**	:	10m
12	**Area**	:	360 sq.m
13	**Depth**	:	1m
14	**Volume**	:	360 cu.m
15	**Run out Distance**	:	2m
16	**Type of Material**	:	Debris
17	**Type of Movement**	:	Slide
18	**Rate of movement**	:	Moderate
19	**Activity**	:	Suspended
20	**Distribution**	:	Confined
21	**Style**	:	Multiple
22	**Failure Mechanism**	:	Shallow Planar Failure
23	**History**	:	Monsoon 2019
24	**Geomorphology**	:	Moderately dissected
25	**Geology/ Lithology**	:	Soil covered
26	**Structure**	:	Nil
27	**Land use/ Land Cover**	:	Dense Vegetation
28	**Hydrological condition**	:	Dry
29	**Triggering factor**	:	Rainfall
30	**Death of persons**	:	Nil
31	**People affected**	:	Nil
32	**Livestock loss**	:	Nil
33	**Communication**	:	Nil
34	**Infrastructure**	:	Road
35	**Agriculture/ Forest/ Barren**	:	Forest
36	**Geo-scientific causes**	:	Unplanned cutting of slope

37	**Remedial measures**	:	Benching of slope. Reduce the gradient of slope along with plantation on the slope.
38	**Remarks, if any**	:	ECS along slide landslide
39	**Photo**	:	File corrupted.
40	**Summary/ Abstract**	:	The slope failure occurred due to unscientific cutting of slope for construction of roads. The slope gradient is very high and there is thick vegetation on the upper slopes, making it susceptible to failure. Extensive cut slopes are present on both sides of the landslide.
41	**Date of Reporting**	:	18.01.2020
42	**Landslide Category**	:	1

	Field	:	Description
	Location No	:	397
1	**Slide No**	:	68
2	**State**	:	Karnataka
3	**District**	:	Uttara Kannada
4	**Toposheet**	:	48I/12
5	**Name of Slide**	:	KAR/UK/48I12/2019/68
6	**NH/SH/Locality**	:	Bapeli village
7	**Latitude**	:	15° 13' 1.621" N
8	**Longitude**	:	74° 32' 24.958" E
9	**Length**	:	18m
10	**Width**	:	70m
11	**Height**	:	10m
12	**Area**	:	1260 sq.m
13	**Depth**	:	2m
14	**Volume**	:	3520 cu.m
15	**Run out Distance**	:	3m
16	**Type of Material**	:	Debris
17	**Type of Movement**	:	Slide
18	**Rate of movement**	:	Moderate
19	**Activity**	:	Suspended
20	**Distribution**	:	Confined
21	**Style**	:	Single
22	**Failure Mechanism**	:	Shallow Planar Failure
23	**History**	:	Monsoon 2019
24	**Geomorphology**	:	Moderately dissected
25	**Geology/ Lithology**	:	Soil covered
26	**Structure**	:	Nil
27	**Land use/ Land Cover**	:	Dense Vegetation
28	**Hydrological condition**	:	Dry
29	**Triggering factor**	:	Rainfall
30	**Death of persons**	:	Nil
31	**People affected**	:	Nil
32	**Livestock loss**	:	Nil

33	**Communication**	:	Nil
34	**Infrastructure**	:	Nil
35	**Agriculture/ Forest/ Barren**	:	Forest
36	**Geo-scientific causes**	:	Unplanned cutting of slope
37	**Remedial measures**	:	Slope to be benched to reduce the gradient. Drainage to be given
38	**Remarks, if any**	:	Nil
39	**Photo**	:	
40	**Summary/ Abstract**	:	The slope failure occurred due to unscientific cutting of slope for construction of roads. The slope gradient is very high and there is thick vegetation on the upper slopes, making it susceptible to failure.
41	**Date of Reporting**	:	18.01.2020
42	**Landslide Category**	:	3

	Field	:	Description
	Location No	:	401
1	**Slide No**	:	69
2	**State**	:	Karnataka
3	**District**	:	Uttara Kannada
4	**Toposheet**	:	48I/12
5	**Name of Slide**	:	KAR/UK/48I12/2019/69
6	**NH/SH/Locality**	:	Kodli village
7	**Latitude**	:	15° 13' 37.795" N
8	**Longitude**	:	74° 32' 16.254" E
9	**Length**	:	15m
10	**Width**	:	120m
11	**Height**	:	10m
12	**Area**	:	1800 sq.m
13	**Depth**	:	1m
14	**Volume**	:	1800 cu.m
15	**Run out Distance**	:	4m
16	**Type of Material**	:	Debris
17	**Type of Movement**	:	Slide
18	**Rate of movement**	:	Moderate
19	**Activity**	:	Suspended
20	**Distribution**	:	Widening
21	**Style**	:	Multiple
22	**Failure Mechanism**	:	Shallow Planar Failure
23	**History**	:	Monsoon 2019
24	**Geomorphology**	:	Moderately dissected
25	**Geology/ Lithology**	:	Soil covered
26	**Structure**	:	Nil
27	**Land use/ Land Cover**	:	Dense Vegetation
28	**Hydrological condition**	:	Dry
29	**Triggering factor**	:	Rainfall
30	**Death of persons**	:	Nil
31	**People affected**	:	Nil
32	**Livestock loss**	:	Nil
33	**Communication**	:	Nil

34	**Infrastructure**	:	Nil
35	**Agriculture/ Forest/ Barren**	:	Nil
36	**Geo-scientific causes**	:	Unplanned cutting of slope
37	**Remedial measures**	:	Slope to be benched to reduce the gradient. Drainage to be given along with plantation along the slope.
38	**Remarks, if any**	:	Nil
39	**Photo**	:	
40	**Summary/ Abstract**	:	The slope failure occurred due to unscientific cutting of slope for construction of roads. The slope gradient is very high and there is thick vegetation on the upper slopes, making it susceptible to failure.
41	**Date of Reporting**	:	18.01.2020
42	**Landslide Category**	:	3

	Field	:	Description
	Location No	:	422
1	**Slide No**	:	70
2	**State**	:	Karnataka
3	**District**	:	Uttara Kannada
4	**Toposheet**	:	48I/12
5	**Name of Slide**	:	KAR/UK/48I12/2019/70
6	**NH/SH/Locality**	:	Dhumma Gudda
7	**Latitude**	:	15° 2' 19.455" N
8	**Longitude**	:	74° 38' 15.930" E
9	**Length**	:	10m
10	**Width**	:	20m
11	**Height**	:	8m
12	**Area**	:	200 sq.m
13	**Depth**	:	1m
14	**Volume**	:	200 cu.m
15	**Run out Distance**	:	2m
16	**Type of Material**	:	Debris
17	**Type of Movement**	:	Slide
18	**Rate of movement**	:	Moderate
19	**Activity**	:	Suspended
20	**Distribution**	:	Widening
21	**Style**	:	Single
22	**Failure Mechanism**	:	Shallow Planar Failure
23	**History**	:	Monsoon 2019
24	**Geomorphology**	:	Moderately dissected
25	**Geology/ Lithology**	:	Meta phyllite
26	**Structure**	:	Jointed
27	**Land use/ Land Cover**	:	Dense Vegetation
28	**Hydrological condition**	:	Dry
29	**Triggering factor**	:	Rainfall
30	**Death of persons**	:	Nil
31	**People affected**	:	Nil
32	**Livestock loss**	:	Nil
33	**Communication**	:	Nil
34	**Infrastructure**	:	Road
35	**Agriculture/ Forest/ Barren**	:	Forest
36	**Geo-scientific causes**	:	Unplanned cutting of slope

37	**Remedial measures**	:	Appropriate toe support for retaining slided material. Drainage maintenance along with plantation on the slope
38	**Remarks, if any**	:	Nil
39	**Photo**	:	Photo file corrupted.
40	**Summary/ Abstract**	:	The slope failure occurred due to unscientific cutting of slope for construction of roads. The slope gradient is very high and there is thick vegetation on the upper slopes, making it susceptible to failure.
41	**Date of Reporting**	:	19.01.2020
42	**Landslide Category**	:	3

	Field	:	Description
	Location No	:	424
1	**Slide No**	:	71
2	**State**	:	Karnataka
3	**District**	:	Uttara Kannada
4	**Toposheet**	:	48J/9
5	**Name of Slide**	:	KAR/UK/48I12/2019/71
6	**NH/SH/Locality**	:	Bisgod
7	**Latitude**	:	14° 59' 59.986" N
8	**Longitude**	:	74° 38' 48.708" E
9	**Length**	:	50m
10	**Width**	:	100m
11	**Height**	:	20m
12	**Area**	:	5000 sq.m
13	**Depth**	:	5m
14	**Volume**	:	25000 cu.m
15	**Run out Distance**	:	10m
16	**Type of Material**	:	Debris
17	**Type of Movement**	:	Slide
18	**Rate of movement**	:	Rapid
19	**Activity**	:	Suspended
20	**Distribution**	:	Advancing, Widening
21	**Style**	:	Multiple
22	**Failure Mechanism**	:	Shallow Planar Failure
23	**History**	:	Monsoon 2019
24	**Geomorphology**	:	Moderately dissected
25	**Geology/ Lithology**	:	Meta phyllite
26	**Structure**	:	Jointed
27	**Land use/ Land Cover**	:	Dense Vegetation
28	**Hydrological condition**	:	Dry
29	**Triggering factor**	:	Rainfall
30	**Death of persons**	:	Nil
31	**People affected**	:	Nil
32	**Livestock loss**	:	Nil

33	**Communication**	:	Nil
34	**Infrastructure**	:	Road
35	**Agriculture/ Forest/ Barren**	:	Forest
36	**Geo-scientific causes**	:	Pore water pressure. Toe erosion by stream. Unplnnned cutting of slope
37	**Remedial measures**	:	Proper drainage arrangement. Appropriate toe support for retaining the slided material along with plantation along the slope
38	**Remarks, if any**	:	Nil
39	**Photo**	:	
40	**Summary/ Abstract**	:	The area represents a very complex slide. The entire slope has failed. Along the same slope, where rock is present, rock slide has occurred. In the area where soil is present, earth slide is observed and in between the two, a debris slide is observed. The slope has failed both upslope and down slope. At the base of the slope, there is a river flowing. The river originated somewhere upslope. Along the river also, the valleys have slided giving landslides.
41	**Date of Reporting**	:	19.02.2020
42	**Landslide Category**	:	1

	Field	:	Description
	Location No	:	454
1	**Slide No**	:	72
2	**State**	:	Karnataka
3	**District**	:	Uttara Kannada
4	**Toposheet**	:	48I/12
5	**Name of Slide**	:	KAR/UK/48I12/2019/72
6	**NH/SH/Locality**	:	Narsur village
7	**Latitude**	:	15° 2' 52.986" N
8	**Longitude**	:	74° 38' 1.271" E
9	**Length**	:	15m
10	**Width**	:	20m
11	**Height**	:	10m
12	**Area**	:	300 sq.m
13	**Depth**	:	2m
14	**Volume**	:	600 cu.m
15	**Run out Distance**	:	4m
16	**Type of Material**	:	Debris
17	**Type of Movement**	:	Slide
18	**Rate of movement**	:	Moderate
19	**Activity**	:	Suspended
20	**Distribution**	:	Widening
21	**Style**	:	Single
22	**Failure Mechanism**	:	Shallow Planar Failure
23	**History**	:	August 2019
24	**Geomorphology**	:	Moderately dissected
25	**Geology/ Lithology**	:	Soil covered
26	**Structure**	:	Nil
27	**Land use/ Land Cover**	:	Dense vegetation
28	**Hydrological condition**	:	Dry
29	**Triggering factor**	:	Rainfall
30	**Death of persons**	:	Nil
31	**People affected**	:	Nil
32	**Livestock loss**	:	Nil

33	**Communication**	:	Nil
34	**Infrastructure**	:	Nil
35	**Agriculture/ Forest/ Barren**	:	Nil
36	**Geo-scientific causes**	:	Toe erosion by stream. Increase in unit mass during rains
37	**Remedial measures**	:	Slope to be benched to reduce gradient. Proper drainage to be given.
38	**Remarks, if any**	:	Entire slope collapsed during the rains in August 2019. Further cracks developed downstream due o excessive water flowing through the stream.
39	**Photo**	:	
40	**Summary/ Abstract**	:	The landslide has occurred by erosion of the toe of the slope by the stream flowing at the base. During rainfall, the water flow tends to become turbulent causing the river to erode its banks.
41	**Date of Reporting**	:	21.01.2020
42	**Landslide Category**	:	2

	Field	:	Description
	Location No	:	456
1	**Slide No**	:	73
2	**State**	:	Karnataka
3	**District**	:	Uttara Kannada
4	**Toposheet**	:	48I/12
5	**Name of Slide**	:	KAR/UK/48I12/2019/73
6	**NH/SH/Locality**	:	Narasur village
7	**Latitude**	:	15° 2' 29.285" N
8	**Longitude**	:	74° 38' 10.892" E
9	**Length**	:	20
10	**Width**	:	15
11	**Height**	:	8
12	**Area**	:	300
13	**Depth**	:	1
14	**Volume**	:	300 cu.m
15	**Run out Distance**	:	4m
16	**Type of Material**	:	Soil
17	**Type of Movement**	:	Slide
18	**Rate of movement**	:	Rapid
19	**Activity**	:	Suspended
20	**Distribution**	:	Confined
21	**Style**	:	Single
22	**Failure Mechanism**	:	Deep Planar Failure
23	**History**	:	Monsoon 2019
24	**Geomorphology**	:	Moderately dissected
25	**Geology/ Lithology**	:	Soil covered
26	**Structure**	:	Nil
27	**Land use/ Land Cover**	:	Dense vegetation
28	**Hydrological condition**	:	Dry
29	**Triggering factor**	:	Rainfall
30	**Death of persons**	:	Nil
31	**People affected**	:	Nil
32	**Livestock loss**	:	Nil

33	**Communication**	:	Nil
34	**Infrastructure**	:	Road
35	**Agriculture/ Forest/ Barren**	:	Forest, Agriculutre
36	**Geo-scientific causes**	:	Toe erosion by stream. Increase in unit mass
37	**Remedial measures**	:	Toe support by appropriate concrete measures. Proper drainage network along with plantation along the slope.
38	**Remarks, if any**	:	Nil
39	**Photo**	:	
40	**Summary/ Abstract**	:	The landslide has occurred by erosion of the toe of the slope by the stream flowing at the base. During rainfall, the water flow tends to become turbulent causing the river to erode its banks.
41	**Date of Reporting**	:	21.01.2020
42	**Landslide Category**	:	3

	Field	:	Description
	Location No	:	467
1	**Slide No**	:	74
2	**State**	:	Karnataka
3	**District**	:	Uttara Kannada
4	**Toposheet**	:	48J/13
5	**Name of Slide**	:	KAR/UK/48J13/2019/74
6	**NH/SH/Locality**	:	Onithotta village
7	**Latitude**	:	14° 46' 51.734" N
8	**Longitude**	:	74° 50' 13.661" E
9	**Length**	:	15m
10	**Width**	:	50m
11	**Height**	:	10m
12	**Area**	:	750 sq.m
13	**Depth**	:	1m
14	**Volume**	:	750 NA
15	**Run out Distance**	:	2m
16	**Type of Material**	:	Soil
17	**Type of Movement**	:	Slide
18	**Rate of movement**	:	Rapid
19	**Activity**	:	Suspended
20	**Distribution**	:	Widening
21	**Style**	:	Single
22	**Failure Mechanism**	:	Shallow Planar Failure
23	**History**	:	Aug-Sept 2019
24	**Geomorphology**	:	Lowly dissected
25	**Geology/ Lithology**	:	Weathered meta argillite
26	**Structure**	:	Nil
27	**Land use/ Land Cover**	:	Cultivation on upper slope
28	**Hydrological condition**	:	Wet
29	**Triggering factor**	:	Rainfall
30	**Death of persons**	:	Nil
31	**People affected**	:	Nil
32	**Livestock loss**	:	Nil
33	**Communication**	:	Nil
34	**Infrastructure**	:	Nil
35	**Agriculture/ Forest/ Barren**	:	Forest, Agriculture

36	**Geo-scientific causes**	:	Toe erosion by stream. Increase in unit mass
37	**Remedial measures**	:	Toe support by appropriate concrete measures. Proper drainage network to be given. Bench the slope and plantation be provided along the slope.
38	**Remarks, if any**	:	The land owners have given a barrage on stream. Drain is given on upper slope. During heavy rain, the upper drain overflowed, increasing unit mass and thereby causing sliding.
39	**Photo**	:	
40	**Summary/ Abstract**	:	The landslide has occurred by erosion of the toe of the slope by the stream flowing at the base. During rainfall, the water flow tends to become turbulent causing the river to erode its banks.
41	**Date of Reporting**	:	04.02.2020
42	**Landslide Category**	:	2

	Field	:	Description
	Location No	:	468
1	**Slide No**	:	75
2	**State**	:	Karnataka
3	**District**	:	Uttara Kannada
4	**Toposheet**	:	48J/13
5	**Name of Slide**	:	KAR/UK/48J13/2019/75
6	**NH/SH/Locality**	:	Onithotta village
7	**Latitude**	:	14.84167
8	**Longitude**	:	74.83778
9	**Length**	:	18m
10	**Width**	:	100m
11	**Height**	:	15m
12	**Area**	:	1800 sq.m
13	**Depth**	:	2m
14	**Volume**	:	3600 cu.m
15	**Run out Distance**	:	4m
16	**Type of Material**	:	Debris
17	**Type of Movement**	:	Slide
18	**Rate of movement**	:	Rapid
19	**Activity**	:	Suspended
20	**Distribution**	:	Widening
21	**Style**	:	Single
22	**Failure Mechanism**	:	Deep Planar Failure
23	**History**	:	Aug-Sept 2019
24	**Geomorphology**	:	Moderately dissected
25	**Geology/ Lithology**	:	Meta argillite
26	**Structure**	:	Nil
27	**Land use/ Land Cover**	:	Cultivation, Forest
28	**Hydrological condition**	:	Dry
29	**Triggering factor**	:	Rainfall
30	**Death of persons**	:	Nil
31	**People affected**	:	Nil
32	**Livestock loss**	:	Nil
33	**Communication**	:	Nil

34	**Infrastructure**	:	Nil
35	**Agriculture/ Forest/ Barren**	:	Forest, Agriculutre
36	**Geo-scientific causes**	:	Toe erosion by stream. Increase in unit mass
37	**Remedial measures**	:	Toe support by appropriate concrete measures. Proper drainage network. Bench the slope along with plantation on the slope
38	**Remarks, if any**	:	Nil
39	**Photo**	:	
40	**Summary/ Abstract**	:	Well defined slip plane present. It's an earth slide with few trees. Big trees have fallen during the slide. Along the base of the stream, rock has been exposed. The rainfall was accompanied by strong winds.
41	**Date of Reporting**	:	04.02.2020
42	**Landslide Category**	:	2

	Field	:	Description
	Location No	:	472
1	**Slide No**	:	76
2	**State**	:	Karnataka
3	**District**	:	Uttara Kannada
4	**Toposheet**	:	48J/13
5	**Name of Slide**	:	KAR/UK/48J13/2019/76
6	**NH/SH/Locality**	:	Tarehalli village
7	**Latitude**	:	14.7979
8	**Longitude**	:	74.82721
9	**Length**	:	10m
10	**Width**	:	150m
11	**Height**	:	8m
12	**Area**	:	1500 sq.m
13	**Depth**	:	2m
14	**Volume**	:	3000 cu.m
15	**Run out Distance**	:	2m
16	**Type of Material**	:	Debris
17	**Type of Movement**	:	Slide
18	**Rate of movement**	:	Rapid
19	**Activity**	:	Suspended
20	**Distribution**	:	Widening
21	**Style**	:	Multiple
22	**Failure Mechanism**	:	Shallow Planar Failure
23	**History**	:	Oct-19
24	**Geomorphology**	:	Moderately dissected
25	**Geology/ Lithology**	:	Soil covered
26	**Structure**	:	Nil
27	**Land use/ Land Cover**	:	Moderate vegetation, Cultivation
28	**Hydrological condition**	:	Dry
29	**Triggering factor**	:	Rainfall
30	**Death of persons**	:	Nil
31	**People affected**	:	Nil
32	**Livestock loss**	:	Nil
33	**Communication**	:	Nil
34	**Infrastructure**	:	Nil
35	**Agriculture/ Forest/ Barren**	:	Agriculture

36	**Geo-scientific causes**	:	Toe erosion by stream
37	**Remedial measures**	:	Toe support by concrete measures. If possible widen the stream valley to allow more inflow of water
38	**Remarks, if any**	:	Nil
39	**Photo**	:	
40	**Summary/ Abstract**	:	The landslide has occurred by erosion of the toe of the slope by the stream flowing at the base. During rainfall, the water flow tends to become turbulent causing the river to erode its banks.
41	**Date of Reporting**	:	04.02.2020
42	**Landslide Category**	:	2

	Field	:	Description
	Location No	:	491
1	**Slide No**	:	77
2	**State**	:	Karnataka
3	**District**	:	Uttara Kannada
4	**Toposheet**	:	48J/13
5	**Name of Slide**	:	KAR/UK/48J13/2019/77
6	**NH/SH/Locality**	:	Anejaddi village
7	**Latitude**	:	14° 54' 3.759" N
8	**Longitude**	:	74° 49' 21.311" E
9	**Length**	:	10m
10	**Width**	:	20m
11	**Height**	:	8m
12	**Area**	:	200 sq.m
13	**Depth**	:	1m
14	**Volume**	:	200 cu.m
15	**Run out Distance**	:	2m
16	**Type of Material**	:	Debris
17	**Type of Movement**	:	Slide
18	**Rate of movement**	:	Rapid
19	**Activity**	:	Suspended
20	**Distribution**	:	Widening
21	**Style**	:	Multiple
22	**Failure Mechanism**	:	Shallow Planar Failure
23	**History**	:	Monsoon 2019
24	**Geomorphology**	:	Lowly dissected
25	**Geology/ Lithology**	:	Meta argillite
26	**Structure**	:	Nil
27	**Land use/ Land Cover**	:	Forest on upper slope
28	**Hydrological condition**	:	Dry
29	**Triggering factor**	:	Rainfall
30	**Death of persons**	:	Nil
31	**People affected**	:	Nil

32	**Livestock loss**	:	Nil
33	**Communication**	:	Nil
34	**Infrastructure**	:	Nil
35	**Agriculture/ Forest/ Barren**	:	Forest, Agriculture
36	**Geo-scientific causes**	:	Toe erosion by stream
37	**Remedial measures**	:	Toe support by concrete measures. Bench the slope to reduce the gradient. Plantation may be given along the slope
38	**Remarks, if any**	:	Stream shifted to one end of cultivated patch
39	**Photo**	:	
40	**Summary/ Abstract**	:	The landslide has occurred by erosion of the toe of the slope by the stream flowing at the base. During rainfall, the water flow tends to become turbulent causing the river to erode its banks.
41	**Date of Reporting**	:	05.02.2020
42	**Landslide Category**	:	3

	Field	:	Description
	Location No	:	507
1	**Slide No**	:	78
2	**State**	:	Karnataka
3	**District**	:	Uttara Kannada
4	**Toposheet**	:	48J/13
5	**Name of Slide**	:	KAR/UK/48J13/2019/78
6	**NH/SH/Locality**	:	Hasangi village
7	**Latitude**	:	14° 51' 14.452" N
8	**Longitude**	:	74° 49' 57.939" E
9	**Length**	:	10m
10	**Width**	:	20m
11	**Height**	:	8m
12	**Area**	:	200 sq.m
13	**Depth**	:	2m
14	**Volume**	:	400 cu.m
15	**Run out Distance**	:	2m
16	**Type of Material**	:	Debris
17	**Type of Movement**	:	Slide
18	**Rate of movement**	:	Moderate
19	**Activity**	:	Suspended
20	**Distribution**	:	Retrogressive
21	**Style**	:	Multiple
22	**Failure Mechanism**	:	Shallow Planar Failure
23	**History**	:	Monsoon 2019
24	**Geomorphology**	:	Lowly dissected
25	**Geology/ Lithology**	:	Meta argillite
26	**Structure**	:	Nil
27	**Land use/ Land Cover**	:	Moderate vegetation
28	**Hydrological condition**	:	Dry
29	**Triggering factor**	:	Rainfall
30	**Death of persons**	:	Nil
31	**People affected**	:	Nil
32	**Livestock loss**	:	Nil

33	**Communication**	:	Nil
34	**Infrastructure**	:	Bridge, Road
35	**Agriculture/ Forest/ Barren**	:	Forest
36	**Geo-scientific causes**	:	Loading at head region
37	**Remedial measures**	:	Reduce the gradient of slope.
38	**Remarks, if any**	:	Thick vegetation along the upper slope- big trees such as bamboo observed. the slope is adjacent to a stream, but no river action observed
39	**Photo**	:	
40	**Summary/ Abstract**	:	Thick vegetation along the upper slope- big trees such as bamboo observed. The loading at the head has led to failure of the slope. The slope is adjacent to a stream, but no river action observed
41	**Date of Reporting**	:	06.02.2020
42	**Landslide Category**	:	3

	Field	:	Description
	Location No	:	508
1	**Slide No**	:	79
2	**State**	:	Karnataka
3	**District**	:	Uttara Kannada
4	**Toposheet**	:	48J/13
5	**Name of Slide**	:	KAR/UK/48J13/2019/79
6	**NH/SH/Locality**	:	Devarkalahalli village
7	**Latitude**	:	14° 51' 8.789" N
8	**Longitude**	:	74° 50' 45.853" E
9	**Length**	:	13m
10	**Width**	:	25m
11	**Height**	:	10m
12	**Area**	:	325 sq.m
13	**Depth**	:	2m
14	**Volume**	:	650 cu.m
15	**Run out Distance**	:	2m
16	**Type of Material**	:	Debris
17	**Type of Movement**	:	Slide
18	**Rate of movement**	:	Moderate
19	**Activity**	:	Suspended
20	**Distribution**	:	Widening
21	**Style**	:	Single
22	**Failure Mechanism**	:	Shallow Planar Failure
23	**History**	:	July-August 2019
24	**Geomorphology**	:	Lowly dissected
25	**Geology/ Lithology**	:	Meta argillite
26	**Structure**	:	Nil
27	**Land use/ Land Cover**	:	Moderate vegetation
28	**Hydrological condition**	:	Dry
29	**Triggering factor**	:	Rainfall
30	**Death of persons**	:	Nil
31	**People affected**	:	Nil
32	**Livestock loss**	:	Nil

33	**Communication**	:	Nil
34	**Infrastructure**	:	Nil
35	**Agriculture/ Forest/ Barren**	:	Forest, Agriculture
36	**Geo-scientific causes**	:	Toe erosion by stream
37	**Remedial measures**	:	Provide proper drainage upslope. Toe support by concrete measures, along with plantation on the slope.
38	**Remarks, if any**	:	Post sliding, large cracks have been formed perpendicular to the stream in the fields along which water was found flowing after stream was blocked
39	**Photo**	:	
40	**Summary/ Abstract**	:	Small stream flowing along base caused toe erosion during heavy erosion. The entire slope collapsed at one go. A tank with water is present nearby, which was completely blocked post sliding.
41	**Date of Reporting**	:	06.02.2020
42	**Landslide Category**	:	3

	Field	:	Description
	Location No	:	514
1	**Slide No**	:	80
2	**State**	:	Karnataka
3	**District**	:	Uttara Kannada
4	**Toposheet**	:	48J/14
5	**Name of Slide**	:	KAR/UK/48J14/2019/80
6	**NH/SH/Locality**	:	Kansur village
7	**Latitude**	:	14° 30' 37.058" N
8	**Longitude**	:	74° 50' 3.719" E
9	**Length**	:	25m
10	**Width**	:	60m
11	**Height**	:	22m
12	**Area**	:	1500 sq.m
13	**Depth**	:	1.5m
14	**Volume**	:	2250 cu.m
15	**Run out Distance**	:	3m
16	**Type of Material**	:	Soil
17	**Type of Movement**	:	Slide
18	**Rate of movement**	:	Moderate
19	**Activity**	:	Suspended
20	**Distribution**	:	Widening
21	**Style**	:	Multiple
22	**Failure Mechanism**	:	Shallow Planar Failure
23	**History**	:	Aug-19
24	**Geomorphology**	:	Lowly dissected
25	**Geology/ Lithology**	:	Soil covered
26	**Structure**	:	Nil
27	**Land use/ Land Cover**	:	Moderate vegetation
28	**Hydrological condition**	:	Dry
29	**Triggering factor**	:	Rainfall
30	**Death of persons**	:	Nil
31	**People affected**	:	Nil
32	**Livestock loss**	:	Nil

33	**Communication**	:	Nil
34	**Infrastructure**	:	Road
35	**Agriculture/ Forest/ Barren**	:	Forest, Agriculture
36	**Geo-scientific causes**	:	Unplanned cutting of slope. Pore water pressure
37	**Remedial measures**	:	Benching of slope to reduce the gradient along with plantation along the slope
38	**Remarks, if any**	:	Paleo-slides observed on either side of present slide.
39	**Photo**	:	
40	**Summary/ Abstract**	:	The slope failure occurred due to unscientific cutting of slope for construction of roads. The slope gradient is very high and there is thick vegetation on the upper slopes, making it susceptible to failure.
41	**Date of Reporting**	:	07.02.2020
42	**Landslide Category**	:	2

	Field	:	Description
	Location No	:	515
1	**Slide No**	:	81
2	**State**	:	Karnataka
3	**District**	:	Uttara Kannada
4	**Toposheet**	:	48J/14
5	**Name of Slide**	:	KAR/UK/48J14/2019/81
6	**NH/SH/Locality**	:	Kansur village
7	**Latitude**	:	14° 30' 37.972" N
8	**Longitude**	:	74° 50' 4.260" E
9	**Length**	:	18m
10	**Width**	:	35m
11	**Height**	:	15m
12	**Area**	:	630 sq.m
13	**Depth**	:	1.5m
14	**Volume**	:	945 cu.m
15	**Run out Distance**	:	3m
16	**Type of Material**	:	Soil
17	**Type of Movement**	:	Slide
18	**Rate of movement**	:	Moderate
19	**Activity**	:	Suspended
20	**Distribution**	:	Widening
21	**Style**	:	Multiple
22	**Failure Mechanism**	:	Shallow Planar Failure
23	**History**	:	Aug-19
24	**Geomorphology**	:	Lowly dissected
25	**Geology/ Lithology**	:	Meta argillite
26	**Structure**	:	Nil
27	**Land use/ Land Cover**	:	Moderate vegetation
28	**Hydrological condition**	:	Dry
29	**Triggering factor**	:	Rainfall
30	**Death of persons**	:	Nil
31	**People affected**	:	Nil
32	**Livestock loss**	:	Nil

33	**Communication**	:	Nil
34	**Infrastructure**	:	Road
35	**Agriculture/ Forest/ Barren**	:	Forest
36	**Geo-scientific causes**	:	Increase in pore water pressure. Unplanned cutting of slope
37	**Remedial measures**	:	Benching of slope to reduce the gradient. Proper drainage arrangement to be given, along with plantation on the slope
38	**Remarks, if any**	:	Paleoslides observed in either side of present slide.
39	**Photo**	:	
40	**Summary/ Abstract**	:	The slope failure occurred due to unscientific cutting of slope for construction of roads. The slope gradient is very high and there is thick vegetation on the upper slopes, making it susceptible to failure.
41	**Date of Reporting**	:	07.02.2020
42	**Landslide Category**	:	2

	Field	:	Description
	Location No	:	517
1	**Slide No**	:	82
2	**State**	:	Karnataka
3	**District**	:	Uttara Kannada
4	**Toposheet**	:	48J/14
5	**Name of Slide**	:	KAR/UK/48J14/2019/82
6	**NH/SH/Locality**	:	Keremane village
7	**Latitude**	:	14° 30' 34.571" N
8	**Longitude**	:	74° 49' 27.470" E
9	**Length**	:	12m
10	**Width**	:	20m
11	**Height**	:	10m
12	**Area**	:	240 sq.m
13	**Depth**	:	2m
14	**Volume**	:	480 cu.m
15	**Run out Distance**	:	2m
16	**Type of Material**	:	Debris
17	**Type of Movement**	:	Slide
18	**Rate of movement**	:	Moderate
19	**Activity**	:	Suspended
20	**Distribution**	:	Widening
21	**Style**	:	Single
22	**Failure Mechanism**	:	Shallow Planar Failure
23	**History**	:	Sep-19
24	**Geomorphology**	:	Moderately dissected
25	**Geology/ Lithology**	:	Meta argillite
26	**Structure**	:	Nil
27	**Land use/ Land Cover**	:	Moderate vegetation
28	**Hydrological condition**	:	Dry
29	**Triggering factor**	:	Rainfall
30	**Death of persons**	:	Nil
31	**People affected**	:	Nil
32	**Livestock loss**	:	Nil

33	**Communication**	:	Nil
34	**Infrastructure**	:	Nil
35	**Agriculture/ Forest/ Barren**	:	Forest, Agriculture
36	**Geo-scientific causes**	:	Increase in pore water pressure. Loading at head region
37	**Remedial measures**	:	Benching of slope to reduce the gradient. Proper drainage arrangement to be given along with plantation on the slope
38	**Remarks, if any**	:	Thick overburden present, nearly 3-4m. Moreover thick vegetation on upper slope added to more pressure
39	**Photo**	:	
40	**Summary/ Abstract**	:	The slope has been cut for agricultural and construction material (soil) purposes. The steep slope accompanied by loading at head has led to failure of slope.
41	**Date of Reporting**	:	07.02.2020
42	**Landslide Category**	:	3

	Field	:	Description
	Location No	:	518
1	**Slide No**	:	83
2	**State**	:	Karnataka
3	**District**	:	Uttara Kannada
4	**Toposheet**	:	48J/14
5	**Name of Slide**	:	KAR/UK/48J14/2019/83
6	**NH/SH/Locality**	:	Keremane village
7	**Latitude**	:	14° 30' 31.158" N
8	**Longitude**	:	74° 49' 23.277" E
9	**Length**	:	30m
10	**Width**	:	50m
11	**Height**	:	25m
12	**Area**	:	1500 sq.m
13	**Depth**	:	1m
14	**Volume**	:	1500 cu.m
15	**Run out Distance**	:	3m
16	**Type of Material**	:	Debris
17	**Type of Movement**	:	Slide
18	**Rate of movement**	:	Moderate
19	**Activity**	:	Suspended
20	**Distribution**	:	Widening
21	**Style**	:	Multiple
22	**Failure Mechanism**	:	Shallow Planar Failure
23	**History**	:	Aug-19
24	**Geomorphology**	:	Moderately dissected
25	**Geology/ Lithology**	:	Soil covered
26	**Structure**	:	Nil
27	**Land use/ Land Cover**	:	Moderate vegetation
28	**Hydrological condition**	:	Dry
29	**Triggering factor**	:	Rainfall
30	**Death of persons**	:	Nil
31	**People affected**	:	Nil
32	**Livestock loss**	:	Nil

33	**Communication**	:	Nil
34	**Infrastructure**	:	Nil
35	**Agriculture/ Forest/ Barren**	:	Forest, Agriculture
36	**Geo-scientific causes**	:	Increase in pore water pressure. Loading at head region
37	**Remedial measures**	:	Benching of slope to reduce the gradient. Proper drainage arrangement to be given. Plantation may be provided along the slope.
38	**Remarks, if any**	:	Entire slope is sliding. Moreover the land owner has removed soil for agricultural purpose.
39	**Photo**	:	
40	**Summary/ Abstract**	:	The slope has been cut for agricultural and construction material (soil) purposes. The steep slope accompanied by loading at head has led to failure of slope.
41	**Date of Reporting**	:	07.02.2020
42	**Landslide Category**	:	3

	Field	:	Description
	Location No	:	519
1	**Slide No**	:	84
2	**State**	:	Karnataka
3	**District**	:	Uttara Kannada
4	**Toposheet**	:	48 J/14
5	**Name of Slide**	:	KAR/UK/48J14/2019/84
6	**NH/SH/Locality**	:	Sankadamane, Yelgar Mane
7	**Latitude**	:	14° 30' 24.680" N
8	**Longitude**	:	74° 49' 14.079" E
9	**Length**	:	45m
10	**Width**	:	50m
11	**Height**	:	40m
12	**Area**	:	2250 sq.m
13	**Depth**	:	2m
14	**Volume**	:	4500 cu.m
15	**Run out Distance**	:	5m
16	**Type of Material**	:	Soil
17	**Type of Movement**	:	Slide
18	**Rate of movement**	:	Rapid
19	**Activity**	:	Suspended
20	**Distribution**	:	Widening
21	**Style**	:	Single
22	**Failure Mechanism**	:	Shallow Planar Failure
23	**History**	:	Audgust- September, 2019
24	**Geomorphology**	:	Moderately dissected
25	**Geology/ Lithology**	:	Soil covered
26	**Structure**	:	Nil
27	**Land use/ Land Cover**	:	Moderate vegetation
28	**Hydrological condition**	:	Dry
29	**Triggering factor**	:	Rainfall
30	**Death of persons**	:	Nil
31	**People affected**	:	Nil

32	**Livestock loss**	:	Nil
33	**Communication**	:	Nil
34	**Infrastructure**	:	Nil
35	**Agriculture/ Forest/ Barren**	:	Forest
36	**Geo-scientific causes**	:	Toe erosion by stream
37	**Remedial measures**	:	Toe support to be given. Slope to be benched. Slided material not to be removed. Slope to be benched
38	**Remarks, if any**	:	Very thick overburden. Thick vegetation on the crown caused loading, which along with toe erosion lead to failure
39	**Photo**	:	
40	**Summary/ Abstract**	:	The landslide has occurred by erosion of the toe of the slope by the stream flowing at the base. During rainfall, the water flow tends to become turbulent causing the river to erode its banks.
41	**Date of Reporting**	:	07.02.2020
42	**Landslide Category**	:	3

	Field	:	Description
	Location No	:	521
1	**Slide No**	:	85
2	**State**	:	Karnataka
3	**District**	:	Uttara Kannada
4	**Toposheet**	:	48J/14
5	**Name of Slide**	:	KAR/UK/48J14/2019/85
6	**NH/SH/Locality**	:	Yelugar village
7	**Latitude**	:	14° 30' 3.366" N
8	**Longitude**	:	74° 48' 37.841" E
9	**Length**	:	45m
10	**Width**	:	100m
11	**Height**	:	40m
12	**Area**	:	4500 sq.m
13	**Depth**	:	3m
14	**Volume**	:	13500 cu.m
15	**Run out Distance**	:	6m
16	**Type of Material**	:	Debris
17	**Type of Movement**	:	Slide
18	**Rate of movement**	:	Rapid
19	**Activity**	:	Suspended
20	**Distribution**	:	Widening
21	**Style**	:	Multiple
22	**Failure Mechanism**	:	Deep Planar Failure
23	**History**	:	Aug-19
24	**Geomorphology**	:	Moderately dissected
25	**Geology/ Lithology**	:	Soil covered
26	**Structure**	:	Nil
27	**Land use/ Land Cover**	:	Moderate vegetation
28	**Hydrological condition**	:	Dry
29	**Triggering factor**	:	Rainfall
30	**Death of persons**	:	Nil
31	**People affected**	:	Water overflowed into plantation
32	**Livestock loss**	:	Nil

33	**Communication**	:	Nil
34	**Infrastructure**	:	Nil
35	**Agriculture/ Forest/ Barren**	:	Agriculture/Forest
36	**Geo-scientific causes**	:	Toe erosion by stream. Loading at head region
37	**Remedial measures**	:	Toe support to be given. Slope to be benched, along with plantation to be given on the slope. Slided material not to be removed.
38	**Remarks, if any**	:	Thick overburden resent and dense vegetation on the crown.
39	**Photo**	:	
40	**Summary/ Abstract**	:	The landslide has occurred by erosion of the toe of the slope by the stream flowing at the base. During rainfall, the water flow tends to become turbulent causing the river to erode its banks.
41	**Date of Reporting**	:	07.02.2020
42	**Landslide Category**	:	2

	Field	:	Description
	Location No	:	522
1	**Slide No**	:	86
2	**State**	:	Karnataka
3	**District**	:	Uttara Kannada
4	**Toposheet**	:	48J/14
5	**Name of Slide**	:	KAR/UK/48J14/2019/86
6	**NH/SH/Locality**	:	Kansur village
7	**Latitude**	:	14° 30' 58.782" N
8	**Longitude**	:	74° 50' 25.849" E
9	**Length**	:	35m
10	**Width**	:	150m
11	**Height**	:	25m
12	**Area**	:	5250 sq.m
13	**Depth**	:	2m
14	**Volume**	:	10500 cu.m
15	**Run out Distance**	:	5m
16	**Type of Material**	:	Debris
17	**Type of Movement**	:	Slide
18	**Rate of movement**	:	Moderate
19	**Activity**	:	Suspended
20	**Distribution**	:	Widening
21	**Style**	:	Multiple
22	**Failure Mechanism**	:	Shallow Planar Failure
23	**History**	:	Sliding for past 2-3 years
24	**Geomorphology**	:	Lowly dissected
25	**Geology/ Lithology**	:	Soil covered
26	**Structure**	:	Nil
27	**Land use/ Land Cover**	:	Settlement
28	**Hydrological condition**	:	Dry
29	**Triggering factor**	:	Rainfall
30	**Death of persons**	:	Nil
31	**People affected**	:	House on upper slope
32	**Livestock loss**	:	Nil

33	**Communication**	:	Road
34	**Infrastructure**	:	House
35	**Agriculture/ Forest/ Barren**	:	
36	**Geo-scientific causes**	:	Toe erosion by stream. Anthropogenic activities(unplanned cutting of slope)
37	**Remedial measures**	:	Retaining wall to be given. Settlements on upper slope may be shifted
38	**Remarks, if any**	:	Houses present all along the slope. The slope is very steep, almost vertical after years of sliding. Cracks formed almost parallel to the crown upslope. The highway also at risk as the slope near the road has also failed.
39	**Photo**	:	
40	**Summary/ Abstract**	:	The landslide has occurred by erosion of the toe of the slope by the stream flowing at the base. During rainfall, the water flow tends to become turbulent causing the river to erode its banks.
41	**Date of Reporting**	:	08.02.2020
42	**Landslide Category**	:	1

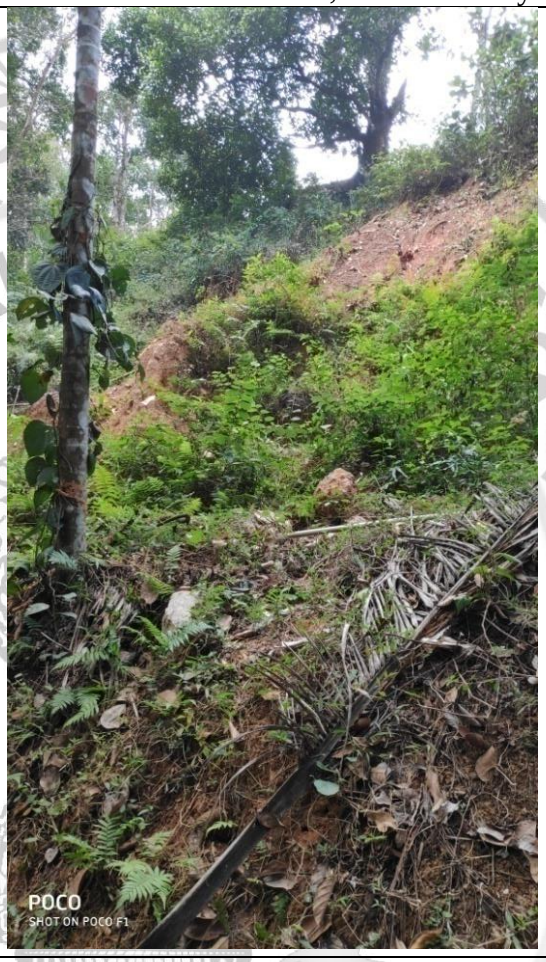
	Field	:	Description
	Location No	:	523
1	**Slide No**	:	87
2	**State**	:	Karnataka
3	**District**	:	Uttara Kannada
4	**Toposheet**	:	48J/14
5	**Name of Slide**	:	KAR/UK/48J14/2019/87
6	**NH/SH/Locality**	:	Kansur village
7	**Latitude**	:	14° 30' 59.745" N
8	**Longitude**	:	74° 50' 23.477" E
9	**Length**	:	22m
10	**Width**	:	100m
11	**Height**	:	18m
12	**Area**	:	2200 sq.m
13	**Depth**	:	2m
14	**Volume**	:	4400 cu.m
15	**Run out Distance**	:	2m
16	**Type of Material**	:	Debris
17	**Type of Movement**	:	Slide
18	**Rate of movement**	:	Moderate
19	**Activity**	:	Suspended
20	**Distribution**	:	Widening
21	**Style**	:	Multiple
22	**Failure Mechanism**	:	Shallow Planar Failure
23	**History**	:	Sliding for past 2-3 years
24	**Geomorphology**	:	Lowly dissected
25	**Geology/ Lithology**	:	Soil covered
26	**Structure**	:	Nil
27	**Land use/ Land Cover**	:	Sparse to moderate vegetation
28	**Hydrological condition**	:	Dry
29	**Triggering factor**	:	Rainfall
30	**Death of persons**	:	Nil
31	**People affected**	:	Nil
32	**Livestock loss**	:	Nil

33	**Communication**	:	Road
34	**Infrastructure**	:	Nil
35	**Agriculture/ Forest/ Barren**	:	Nil
36	**Geo-scientific causes**	:	Toe erosion by stream. Anthropogenic activities(unplanned cutting of slope)
37	**Remedial measures**	:	Retaining wall to be given. Settlements on upper slope may be shifted
38	**Remarks, if any**	:	Nil
39	**Photo**	:	
40	**Summary/ Abstract**	:	The landslide has occurred by erosion of the toe of the slope by the stream flowing at the base. During rainfall, the water flow tends to become turbulent causing the river to erode its banks.
41	**Date of Reporting**	:	08.02.2020
42	**Landslide Category**	:	1

	Field	:	Description
	Location No	:	527
1	**Slide No**	:	88
2	**State**	:	Karnataka
3	**District**	:	Uttara Kannada
4	**Toposheet**	:	48J/14
5	**Name of Slide**	:	KAR/UK/48J14/2019/88
6	**NH/SH/Locality**	:	Dantekal village
7	**Latitude**	:	14° 30' 44.406" N
8	**Longitude**	:	74° 48' 46.107" E
9	**Length**	:	12m
10	**Width**	:	10m
11	**Height**	:	10m
12	**Area**	:	120 sq.m
13	**Depth**	:	1.5m
14	**Volume**	:	180 cu.m
15	**Run out Distance**	:	3m
16	**Type of Material**	:	Debris
17	**Type of Movement**	:	Slide
18	**Rate of movement**	:	Moderate
19	**Activity**	:	Suspended
20	**Distribution**	:	Widening
21	**Style**	:	Multiple
22	**Failure Mechanism**	:	Shallow Planar Failure
23	**History**	:	Monsoon 2019
24	**Geomorphology**	:	Lowly dissected
25	**Geology/ Lithology**	:	Meta-argillite
26	**Structure**	:	Nil
27	**Land use/ Land Cover**	:	Moderate vegetation
28	**Hydrological condition**	:	Dry
29	**Triggering factor**	:	Rainfall
30	**Death of persons**	:	Nil
31	**People affected**	:	Nil
32	**Livestock loss**	:	Nil

33	**Communication**	:	Road
34	**Infrastructure**	:	Nil
35	**Agriculture/ Forest/ Barren**	:	Agriculture/ Forest
36	**Geo-scientific causes**	:	Unplanned cutting of slope. Loading at head region in the form of vegetation-big trees
37	**Remedial measures**	:	Slope to be benched to reduce the gradient along with plantation on the slope.
38	**Remarks, if any**	:	Thick overburden present with dense vegetation on the crown. The slide is on the curve of the road, making it more vulnerable.
39	**Photo**	:	
40	**Summary/ Abstract**	:	The slope failure occurred due to unscientific cutting of slope for construction of roads. The slope gradient is very high and there is thick vegetation on the upper slopes, making it susceptible to failure.
41	**Date of Reporting**	:	08.02.2020
42	**Landslide Category**	:	2

	Field	:	Description
	Location No	:	528
1	**Slide No**	:	89
2	**State**	:	Karnataka
3	**District**	:	Uttara Kannada
4	**Toposheet**	:	48J/14
5	**Name of Slide**	:	KAR/UK/48J14/2019/89
6	**NH/SH/Locality**	:	Dantekal village
7	**Latitude**	:	14° 30' 42.784" N
8	**Longitude**	:	74° 48' 42.103" E
9	**Length**	:	18m
10	**Width**	:	10m
11	**Height**	:	15m
12	**Area**	:	180 sq.m
13	**Depth**	:	2m
14	**Volume**	:	360 cu.m
15	**Run out Distance**	:	3m
16	**Type of Material**	:	Debris
17	**Type of Movement**	:	Slide
18	**Rate of movement**	:	Moderate
19	**Activity**	:	Suspended
20	**Distribution**	:	Widening
21	**Style**	:	Single
22	**Failure Mechanism**	:	Shallow Planar Failure
23	**History**	:	July-Aug 2019
24	**Geomorphology**	:	Moderately dissected
25	**Geology/ Lithology**	:	Laterite
26	**Structure**	:	Nil
27	**Land use/ Land Cover**	:	Moderate vegetation, Cultivation
28	**Hydrological condition**	:	Dry
29	**Triggering factor**	:	Rainfall
30	**Death of persons**	:	Nil
31	**People affected**	:	Cultivated land
32	**Livestock loss**	:	Nil
33	**Communication**	:	Nil
34	**Infrastructure**	:	Nil
35	**Agriculture/ Forest/ Barren**	:	Agriculture/ Forest
36	**Geo-scientific causes**	:	Toe erosion by stream. Anthropogenic activities(unplanned cutting of slope)

37	**Remedial measures**	:	Slope to be benched to reduce the gradient and plantation may be provided along the slope.
38	**Remarks, if any**	:	All along the slope, scarps of earlier slides observed. Many of them have been stabilized, and a few may be reactivated
39	**Photo**	:	
40	**Summary/ Abstract**	:	The landslide has occurred by erosion of the toe of the slope by the stream flowing at the base. During rainfall, the water flow tends to become turbulent causing the river to erode its banks. The slope has also been unscientifically cut.
41	**Date of Reporting**	:	08.02.2020
42	**Landslide Category**	:	3

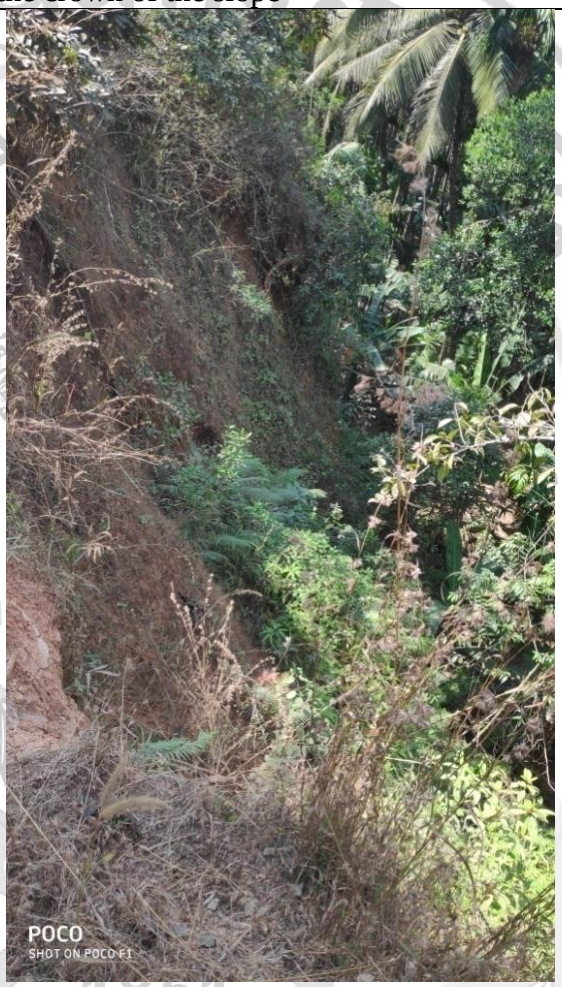
	Field	:	Description
	Location No	:	529
1	**Slide No**	:	90
2	**State**	:	Karnataka
3	**District**	:	Uttara Kannada
4	**Toposheet**	:	48J/14
5	**Name of Slide**	:	KAR/UK/48J14/2019/90
6	**NH/SH/Locality**	:	Dantekal village
7	**Latitude**	:	14° 30' 47.516" N
8	**Longitude**	:	74° 48' 45.262" E
9	**Length**	:	18m
10	**Width**	:	50m
11	**Height**	:	15m
12	**Area**	:	900 sq.m
13	**Depth**	:	5m
14	**Volume**	:	4500 cu.m
15	**Run out Distance**	:	3m
16	**Type of Material**	:	Soil
17	**Type of Movement**	:	Slide
18	**Rate of movement**	:	Moderate
19	**Activity**	:	Suspended
20	**Distribution**	:	Widening
21	**Style**	:	Multiple
22	**Failure Mechanism**	:	Deep Planar Failure
23	**History**	:	Aug-19
24	**Geomorphology**	:	Moderately dissected
25	**Geology/ Lithology**	:	Laterite
26	**Structure**	:	Nil
27	**Land use/ Land Cover**	:	Moderate vegetation
28	**Hydrological condition**	:	Dry
29	**Triggering factor**	:	Rainfall
30	**Death of persons**	:	Nil
31	**People affected**	:	Slide washed soil into fields
32	**Livestock loss**	:	Nil
33	**Communication**	:	Nil
34	**Infrastructure**	:	Nil
35	**Agriculture/ Forest/ Barren**	:	Agriculture/ Forest

36	**Geo-scientific causes**	:	Pore water pressure. Loading at head
37	**Remedial measures**	:	Slope to be benched to reduce the gradient. Plantation to be provided along the slope.
38	**Remarks, if any**	:	Nil
39	**Photo**	:	
40	**Summary/ Abstract**	:	The landslide has occurred due to loading of slope on the crown portion. Drain is present along the crown. During rainfall, excessive water with large rock fragments eroded the walls of the drain, leading to failure of slope
41	**Date of Reporting**	:	08.02.2020
42	**Landslide Category**	:	2

	Field	:	Description
	Location No	:	530
1	**Slide No**	:	91
2	**State**	:	Karnataka
3	**District**	:	Uttara Kannada
4	**Toposheet**	:	48J/14
5	**Name of Slide**	:	KAR/UK/48J14/2019/91
6	**NH/SH/Locality**	:	Dantekal village
7	**Latitude**	:	14° 30' 47.317" N
8	**Longitude**	:	74° 48' 39.164" E
9	**Length**	:	30m
10	**Width**	:	35m
11	**Height**	:	25m
12	**Area**	:	1050 sq.m
13	**Depth**	:	2m
14	**Volume**	:	2100 cu.m
15	**Run out Distance**	:	2m
16	**Type of Material**	:	Soil
17	**Type of Movement**	:	Slide
18	**Rate of movement**	:	Moderate
19	**Activity**	:	Suspended
20	**Distribution**	:	Widening
21	**Style**	:	Single
22	**Failure Mechanism**	:	Shallow Planar Failure
23	**History**	:	Aug-19
24	**Geomorphology**	:	Moderately dissected
25	**Geology/ Lithology**	:	Laterite
26	**Structure**	:	Nil
27	**Land use/ Land Cover**	:	Moderate vegetation
28	**Hydrological condition**	:	Dry
29	**Triggering factor**	:	Rainfall
30	**Death of persons**	:	Nil
31	**People affected**	:	Water overflowed into plantation

32	**Livestock loss**	:	Nil
33	**Communication**	:	Nil
34	**Infrastructure**	:	Nil
35	**Agriculture/ Forest/ Barren**	:	Agriculture/ Forest
36	**Geo-scientific causes**	:	Toe erosion by stream.
37	**Remedial measures**	:	Toe support to be given. Plantation may be given along the slope. Slope to be benched. Slided material not to be removed.
38	**Remarks, if any**	:	Soil removed earlier for cultivation. This year the slope failed. The drain along the crown of the slope is let out here
39	**Photo**	:	
40	**Summary/ Abstract**	:	The landslide has occurred by erosion of the toe of the slope by the stream flowing at the base. During rainfall, the water flow tends to become turbulent causing the river to erode its banks.
41	**Date of Reporting**	:	08.02.2020
42	**Landslide Category**	:	3

	Field	:	Description
	Location No	:	536
1	**Slide No**	:	92
2	**State**	:	Karnataka
3	**District**	:	Uttara Kannada
4	**Toposheet**	:	48J/14
5	**Name of Slide**	:	KAR/UK/48J14/2019/92
6	**NH/SH/Locality**	:	Mukktakai village
7	**Latitude**	:	14° 30' 35.984" N
8	**Longitude**	:	74° 49' 20.421" E
9	**Length**	:	12m
10	**Width**	:	60m
11	**Height**	:	10m
12	**Area**	:	720 sq.m
13	**Depth**	:	1m
14	**Volume**	:	720 cu.m
15	**Run out Distance**	:	2m
16	**Type of Material**	:	Soil
17	**Type of Movement**	:	Slide
18	**Rate of movement**	:	Moderate
19	**Activity**	:	Suspended
20	**Distribution**	:	Widening
21	**Style**	:	Multiple
22	**Failure Mechanism**	:	Shallow Planar Failure
23	**History**	:	2019 Monsoon
24	**Geomorphology**	:	Lowly dissected
25	**Geology/ Lithology**	:	Meta-argillite
26	**Structure**	:	Nil
27	**Land use/ Land Cover**	:	Cultivation
28	**Hydrological condition**	:	Dry
29	**Triggering factor**	:	Rainfall
30	**Death of persons**	:	Nil
31	**People affected**	:	Nil
32	**Livestock loss**	:	Nil
33	**Communication**	:	Road
34	**Infrastructure**	:	Nil

35	**Agriculture/ Forest/ Barren**	:	Nil
36	**Geo-scientific causes**	:	Anthropogenic activity (unplanned cutting of slope)
37	**Remedial measures**	:	Slope to be benched to reduce the gradient. Plantation may be given along the slope.
38	**Remarks, if any**	:	Slope material is highly weathered almost clay like. Road on the crown of the slope
39	**Photo**	:	
40	**Summary/ Abstract**	:	The landslide has occurred by erosion of the toe of the slope by the stream flowing at the base.
41	**Date of Reporting**	:	10.02.2020
42	**Landslide Category**	:	1

	Field	:	Description
	Location No	:	537
1	**Slide No**	:	93
2	**State**	:	Karnataka
3	**District**	:	Uttara Kannada
4	**Toposheet**	:	48J/14
5	**Name of Slide**	:	KAR/UK/48J14/2019/93
6	**NH/SH/Locality**	:	Mukktakai village
7	**Latitude**	:	14° 30' 22.173" N
8	**Longitude**	:	74° 49' 36.803" E
9	**Length**	:	18m
10	**Width**	:	20m
11	**Height**	:	15m
12	**Area**	:	360 sq.m
13	**Depth**	:	2m
14	**Volume**	:	720 cu.m
15	**Run out Distance**	:	3m
16	**Type of Material**	:	Soil
17	**Type of Movement**	:	Slide
18	**Rate of movement**	:	Moderate
19	**Activity**	:	Suspended
20	**Distribution**	:	Widening
21	**Style**	:	Single
22	**Failure Mechanism**	:	Shallow Planar Failure
23	**History**	:	2019 Monsoon
24	**Geomorphology**	:	Lowly dissected
25	**Geology/ Lithology**	:	Soil covered
26	**Structure**	:	Nil
27	**Land use/ Land Cover**	:	Cultivation
28	**Hydrological condition**	:	Dry
29	**Triggering factor**	:	Rainfall
30	**Death of persons**	:	Nil
31	**People affected**	:	Nil
32	**Livestock loss**	:	Nil
33	**Communication**	:	Road
34	**Infrastructure**	:	Nil

35	**Agriculture/ Forest/ Barren**	:	Forest
36	**Geo-scientific causes**	:	Anthropogenic activity (unplanned cutting of slope), Toe erosion bt stream
37	**Remedial measures**	:	Toe support to be given. Slope to be benched along with plantation on the slope. Slided material not to be removed.
38	**Remarks, if any**	:	Down slope of Slide 536
39	**Photo**	:	
40	**Summary/ Abstract**	:	The slope failure occurred due to unscientific cutting of slope for construction of roads. The slope gradient is very high and there is thick vegetation on the upper slopes, making it susceptible to failure.
41	**Date of Reporting**	:	10.02.2020
42	**Landslide Category**	:	2

	Field	:	Description
	Location No	:	538
1	**Slide No**	:	94
2	**State**	:	Karnataka
3	**District**	:	Uttara Kannada
4	**Toposheet**	:	48J/13
5	**Name of Slide**	:	KAR/UK/48J13/2019/94
6	**NH/SH/Locality**	:	Hosamane village
7	**Latitude**	:	14° 45' 53.969" N
8	**Longitude**	:	74° 48' 54.532" E
9	**Length**	:	10m
10	**Width**	:	100m
11	**Height**	:	8m
12	**Area**	:	1000 sq.m
13	**Depth**	:	2
14	**Volume**	:	2000 cu.m
15	**Run out Distance**	:	2m
16	**Type of Material**	:	Debris
17	**Type of Movement**	:	Slide
18	**Rate of movement**	:	Moderate
19	**Activity**	:	Suspended
20	**Distribution**	:	Widening
21	**Style**	:	Multiple
22	**Failure Mechanism**	:	Shallow Planar Failure
23	**History**	:	2019 Monsoon
24	**Geomorphology**	:	Lowly dissected
25	**Geology/ Lithology**	:	Soil covered
26	**Structure**	:	Nil
27	**Land use/ Land Cover**	:	Cultivation
28	**Hydrological condition**	:	Dry
29	**Triggering factor**	:	Rainfall
30	**Death of persons**	:	Nil
31	**People affected**	:	Nil
32	**Livestock loss**	:	Nil
33	**Communication**	:	Nil
34	**Infrastructure**	:	Nil
35	**Agriculture/ Forest/ Barren**	:	Agriculture

36	**Geo-scientific causes**	:	Toe erosion by stream. Loading at head region
37	**Remedial measures**	:	Extensive slope cuts should be avoided. Avoid removal of slided material
38	**Remarks, if any**	:	Nil
39	**Photo**	:	
40	**Summary/ Abstract**	:	The landslide has occurred by erosion of the toe of the slope by the stream flowing at the base. During rainfall, the water flow tends to become turbulent causing the river to erode its banks.
41	**Date of Reporting**	:	11.02.2020
42	**Landslide Category**	:	3

	Field	:	Description
	Location No	:	539
1	**Slide No**	:	95
2	**State**	:	Karnataka
3	**District**	:	Uttara Kannada
4	**Toposheet**	:	48J/13
5	**Name of Slide**	:	KAR/UK/48J13/2019/95
6	**NH/SH/Locality**	:	Chauti village
7	**Latitude**	:	14° 45' 58.091" N
8	**Longitude**	:	74° 48' 49.780" E
9	**Length**	:	15m
10	**Width**	:	70m
11	**Height**	:	10m
12	**Area**	:	1050 sq.m
13	**Depth**	:	2m
14	**Volume**	:	2100 cu.m
15	**Run out Distance**	:	5m
16	**Type of Material**	:	Soil
17	**Type of Movement**	:	Slide
18	**Rate of movement**	:	Moderate
19	**Activity**	:	Suspended
20	**Distribution**	:	Widening
21	**Style**	:	Single
22	**Failure Mechanism**	:	Shallow Planar Failure
23	**History**	:	2019 Monsoon
24	**Geomorphology**	:	Lowly dissected
25	**Geology/ Lithology**	:	Soil covered
26	**Structure**	:	Nil
27	**Land use/ Land Cover**	:	Cultivation
28	**Hydrological condition**	:	Flowing
29	**Triggering factor**	:	Rainfall
30	**Death of persons**	:	Nil
31	**People affected**	:	Nil
32	**Livestock loss**	:	Nil
33	**Communication**	:	Nil
34	**Infrastructure**	:	Nil
35	**Agriculture/ Forest/ Barren**	:	Agriculture

36	**Geo-scientific causes**	:	Toe erosion by stream. Loading at head region
37	**Remedial measures**	:	Bamboo stick pillaring at toe. Plantation on slopes. Avoid extensive cut slopes
38	**Remarks, if any**	:	Nil
39	**Photo**	:	
40	**Summary/ Abstract**	:	The landslide has occurred by erosion of the toe of the slope by the stream flowing at the base. During rainfall, the water flow tends to become turbulent causing the river to erode its banks. The slopes have also been extensively cut for cultivation.
41	**Date of Reporting**	:	11.02.2020
42	**Landslide Category**	:	33

	Field	:	Description
	Location No	:	540
1	**Slide No**	:	96
2	**State**	:	Karnataka
3	**District**	:	Uttara Kannada
4	**Toposheet**	:	48J/13
5	**Name of Slide**	:	KAR/UK/48J13/2019/96
6	**NH/SH/Locality**	:	Chauti village
7	**Latitude**	:	14° 46' 29.497" N
8	**Longitude**	:	74° 48' 41.599" E
9	**Length**	:	15m
10	**Width**	:	80m
11	**Height**	:	12m
12	**Area**	:	1200 sq.m
13	**Depth**	:	2m
14	**Volume**	:	2400 cu.m
15	**Run out Distance**	:	2m
16	**Type of Material**	:	Debris
17	**Type of Movement**	:	Slide
18	**Rate of movement**	:	Moderate
19	**Activity**	:	Reactivated
20	**Distribution**	:	Widening
21	**Style**	:	Multiple
22	**Failure Mechanism**	:	Shallow Planar Failure
23	**History**	:	ols slide
24	**Geomorphology**	:	Lowly dissected
25	**Geology/ Lithology**	:	Meta-phyllite
26	**Structure**	:	Nil
27	**Land use/ Land Cover**	:	Cultivation
28	**Hydrological condition**	:	Dry
29	**Triggering factor**	:	Rainfall
30	**Death of persons**	:	Nil
31	**People affected**	:	Nil
32	**Livestock loss**	:	Nil

33	**Communication**	:	Nil
34	**Infrastructure**	:	Nil
35	**Agriculture/ Forest/ Barren**	:	Agriculture
36	**Geo-scientific causes**	:	Toe erosion by stream. Loading at head region
37	**Remedial measures**	:	Bamboo stick pillaring at toe. Plantation on slopes. Avoid extensive cut slopes
38	**Remarks, if any**	:	Nil
39	**Photo**	:	
40	**Summary/ Abstract**	:	The landslide has occurred by erosion of the toe of the slope by the stream flowing at the base. During rainfall, the water flow tends to become turbulent causing the river to erode its banks.
41	**Date of Reporting**	:	12.02.2020
42	**Landslide Category**	:	3

	Field	:	Description
	Location No	:	541
1	**Slide No**	:	97
2	**State**	:	Karnataka
3	**District**	:	Uttara Kannada
4	**Toposheet**	:	48J/14
5	**Name of Slide**	:	KAR/UK/48J14/2019/97
6	**NH/SH/Locality**	:	Kodsinge village
7	**Latitude**	:	14° 31' 10.201" N
8	**Longitude**	:	74° 48' 26.519" E
9	**Length**	:	12m
10	**Width**	:	80m
11	**Height**	:	8m
12	**Area**	:	960 sq.m
13	**Depth**	:	2m
14	**Volume**	:	1920 cu.m
15	**Run out Distance**	:	2m
16	**Type of Material**	:	Soil
17	**Type of Movement**	:	Slide
18	**Rate of movement**	:	Moderate
19	**Activity**	:	Reactivated
20	**Distribution**	:	Widening
21	**Style**	:	Multiple
22	**Failure Mechanism**	:	Shallow Planar Failure
23	**History**	:	Old slide
24	**Geomorphology**	:	Moderately dissected
25	**Geology/ Lithology**	:	Soil covered
26	**Structure**	:	Nil
27	**Land use/ Land Cover**	:	Cultivation
28	**Hydrological condition**	:	Dry
29	**Triggering factor**	:	Rainfall
30	**Death of persons**	:	Nil
31	**People affected**	:	Nil
32	**Livestock loss**	:	Nil

33	**Communication**	:	Nil
34	**Infrastructure**	:	Nil
35	**Agriculture/ Forest/ Barren**	:	Agriculture
36	**Geo-scientific causes**	:	Toe erosion by stream
37	**Remedial measures**	:	High risk as road is present. Proper retaining structure followed by filling. Avoid removal of material at toe region
38	**Remarks, if any**	:	Nil
39	**Photo**	:	
40	**Summary/ Abstract**	:	The landslide has occurred by erosion of the toe of the slope by the stream flowing at the base. During rainfall, the water flow tends to become turbulent causing the river to erode its banks.
41	**Date of Reporting**	:	13.02.2020
42	**Landslide Category**	:	3

	Field	:	Description
	Location No	:	544
1	**Slide No**	:	98
2	**State**	:	Karnataka
3	**District**	:	Uttara Kannada
4	**Toposheet**	:	48J/14
5	**Name of Slide**	:	KAR/UK/48J14/2019/98
6	**NH/SH/Locality**	:	Dantekal
7	**Latitude**	:	14° 30' 44.689" N
8	**Longitude**	:	74° 48' 41.703" E
9	**Length**	:	15m
10	**Width**	:	25m
11	**Height**	:	10m
12	**Area**	:	375 sq.m
13	**Depth**	:	1.5m
14	**Volume**	:	562.5 cu.m
15	**Run out Distance**	:	3m
16	**Type of Material**	:	Earth
17	**Type of Movement**	:	Slide
18	**Rate of movement**	:	Moderate
19	**Activity**	:	Dormant
20	**Distribution**	:	Confined
21	**Style**	:	Single
22	**Failure Mechanism**	:	Shallow Planar Failure
23	**History**	:	2-3 years back
24	**Geomorphology**	:	Moderately dissected slope
25	**Geology/ Lithology**	:	Soil covered
26	**Structure**	:	Nil
27	**Land use/ Land Cover**	:	Moderate vegetation
28	**Hydrological condition**	:	Dry
29	**Triggering factor**	:	Rainfall
30	**Death of persons**	:	Nil
31	**People affected**	:	Nil
32	**Livestock loss**	:	Nil

33	**Communication**	:	Nil
34	**Infrastructure**	:	Nil
35	**Agriculture/ Forest/ Barren**	:	Nil
36	**Geo-scientific causes**	:	Unplanned cutting of Slope
37	**Remedial measures**	:	Slope stabilized.
38	**Remarks, if any**	:	Nil
39	**Photo**	:	
40	**Summary/ Abstract**	:	The slope has been stabilized and there are very little chances of failure in future.
41	**Date of Reporting**	:	13.02.2020
42	**Landslide Category**	:	3

	Field	:	Description
	Location No	:	548
1	**Slide No**	:	99
2	**State**	:	Karnataka
3	**District**	:	Uttara Kannada
4	**Toposheet**	:	48J/14
5	**Name of Slide**	:	KAR/UK/48J14/2019/99
6	**NH/SH/Locality**	:	Tattikai village
7	**Latitude**	:	14° 30' 7.484" N
8	**Longitude**	:	74° 46' 5.835" E
9	**Length**	:	12m
10	**Width**	:	30m
11	**Height**	:	10m
12	**Area**	:	360 sq.m
13	**Depth**	:	2m
14	**Volume**	:	720 cu.m
15	**Run out Distance**	:	3m
16	**Type of Material**	:	Soil
17	**Type of Movement**	:	Slide
18	**Rate of movement**	:	Moderate
19	**Activity**	:	Dormant
20	**Distribution**	:	Confined
21	**Style**	:	Single
22	**Failure Mechanism**	:	Shallow Planar Failure
23	**History**	:	20 year back
24	**Geomorphology**	:	Moderately dissected
25	**Geology/ Lithology**	:	Soil covered
26	**Structure**	:	Nil
27	**Land use/ Land Cover**	:	Cultivation
28	**Hydrological condition**	:	Dry
29	**Triggering factor**	:	Rainfall
30	**Death of persons**	:	Nil
31	**People affected**	:	Nil
32	**Livestock loss**	:	Nil

33	**Communication**	:	Nil
34	**Infrastructure**	:	Nil
35	**Agriculture/ Forest/ Barren**	:	Agriculture
36	**Geo-scientific causes**	:	Anthropogenic activity (unplanned cutting of slope), Loading at head
37	**Remedial measures**	:	No remedy required as slide is stable.
38	**Remarks, if any**	:	Slide has not failed in past 20-25 years
39	**Photo**	:	
40	**Summary/ Abstract**	:	The slide is a stable slide.
41	**Date of Reporting**	:	14.02.2020
42	**Landslide Category**	:	3

	Field	:	Description
	Location No	:	549
1	**Slide No**	:	100
2	**State**	:	Karnataka
3	**District**	:	Uttara Kannada
4	**Toposheet**	:	48J/14
5	**Name of Slide**	:	KAR/UK/48J14/2019/100
6	**NH/SH/Locality**	:	Bitgod village
7	**Latitude**	:	14° 30' 33.025" N
8	**Longitude**	:	74° 46' 29.031" E
9	**Length**	:	20m
10	**Width**	:	50m
11	**Height**	:	18m
12	**Area**	:	1000 sq.m
13	**Depth**	:	2m
14	**Volume**	:	2000 cu.m
15	**Run out Distance**	:	3m
16	**Type of Material**	:	Soil
17	**Type of Movement**	:	Slide
18	**Rate of movement**	:	Moderate
19	**Activity**	:	Suspended
20	**Distribution**	:	Widening
21	**Style**	:	Multiple
22	**Failure Mechanism**	:	Shallow Planar Failure
23	**History**	:	2018, 2019 monsoons
24	**Geomorphology**	:	Lowly dissected/ Escarpment
25	**Geology/ Lithology**	:	Soil covered
26	**Structure**	:	Nil
27	**Land use/ Land Cover**	:	Cultivation
28	**Hydrological condition**	:	Dry
29	**Triggering factor**	:	Rainfall
30	**Death of persons**	:	Nil
31	**People affected**	:	Slide caused blockage of stream
32	**Livestock loss**	:	Nil

33	**Communication**	:	Nil
34	**Infrastructure**	:	Nil
35	**Agriculture/ Forest/ Barren**	:	Agriculture/ Barren
36	**Geo-scientific causes**	:	Toe erosion by stream
37	**Remedial measures**	:	Toe support with back filling. Benching of slope along with plantation along the slope. Material at toe region not to be removed
38	**Remarks, if any**	:	Soil at base of slope being removed for cultivation, causing further sliding
39	**Photo**	:	
40	**Summary/ Abstract**	:	The landslide has occurred by erosion of the toe of the slope by the stream flowing at the base. During rainfall, the water flow tends to become turbulent causing the river to erode its banks. The loose debris material is removed by the farmers for cultivation purposes, making the slope more vulnerable to failure.
41	**Date of Reporting**	:	14.02.2020
42	**Landslide Category**	:	3

	Field	:	Description
	Location No	:	552
1	**Slide No**	:	101
2	**State**	:	Karnataka
3	**District**	:	Uttara Kannada
4	**Toposheet**	:	
5	**Name of Slide**	:	KAR/UK/48J14/2019/101
6	**NH/SH/Locality**	:	Kumbrigadde village
7	**Latitude**	:	14° 40' 22.691" N
8	**Longitude**	:	74° 50' 51.461" E
9	**Length**	:	10m
10	**Width**	:	20m
11	**Height**	:	8m
12	**Area**	:	200 sq.m
13	**Depth**	:	2m
14	**Volume**	:	400 cu.m
15	**Run out Distance**	:	3m
16	**Type of Material**	:	Debris
17	**Type of Movement**	:	Slide
18	**Rate of movement**	:	Moderate
19	**Activity**	:	Suspended
20	**Distribution**	:	Widening
21	**Style**	:	Multiple
22	**Failure Mechanism**	:	Shallow Planar Failure
23	**History**	:	Monsoon 2019
24	**Geomorphology**	:	Lowly dissected
25	**Geology/ Lithology**	:	Soil covered
26	**Structure**	:	Nil
27	**Land use/ Land Cover**	:	Moderate vegetation
28	**Hydrological condition**	:	Dry
29	**Triggering factor**	:	Rainfall
30	**Death of persons**	:	Nil
31	**People affected**	:	Nil
32	**Livestock loss**	:	Nil

33	**Communication**	:	Nil
34	**Infrastructure**	:	Nil
35	**Agriculture/ Forest/ Barren**	:	Nil
36	**Geo-scientific causes**	:	Toe erosion by stream, Cut slope
37	**Remedial measures**	:	Slope to be benched and plantation to be provided along the slope. Toe support by concrete measures
38	**Remarks, if any**	:	Gravel bed observed at this location.
39	**Photo**	:	
40	**Summary/ Abstract**	:	The landslide has occurred by erosion of the toe of the slope by the stream flowing at the base. During rainfall, the water flow tends to become turbulent causing the river to erode its banks
41	**Date of Reporting**	:	17.02.2020
42	**Landslide Category**	:	3

	Field	:	Description
	Location No	:	553
1	**Slide No**	:	102
2	**State**	:	Karnataka
3	**District**	:	Uttara Kannada
4	**Toposheet**	:	48J/14
5	**Name of Slide**	:	KAR/UK/48J14/2019/102
6	**NH/SH/Locality**	:	Gadkai village
7	**Latitude**	:	14° 41' 46.866" N
8	**Longitude**	:	74° 50' 13.945" E
9	**Length**	:	10m
10	**Width**	:	500m
11	**Height**	:	8m
12	**Area**	:	5000 sq.m
13	**Depth**	:	2m
14	**Volume**	:	10000
15	**Run out Distance**	:	2m
16	**Type of Material**	:	Soil
17	**Type of Movement**	:	Slide
18	**Rate of movement**	:	Moderate
19	**Activity**	:	Suspended
20	**Distribution**	:	Widening
21	**Style**	:	Multiple
22	**Failure Mechanism**	:	Shallow Planar Failure
23	**History**	:	August-Sept 2019
24	**Geomorphology**	:	L
25	**Geology/ Lithology**	:	Meta argillite+Soil
26	**Structure**	:	Nil
27	**Land use/ Land Cover**	:	Moderate vegetation/ Cultivation
28	**Hydrological condition**	:	Dry
29	**Triggering factor**	:	Rainfall
30	**Death of persons**	:	Nil
31	**People affected**	:	Nil
32	**Livestock loss**	:	Nil
33	**Communication**	:	Nil
34	**Infrastructure**	:	Nil
35	**Agriculture/ Forest/ Barren**	:	Agriculture/ Barren

36	**Geo-scientific causes**	:	Toe erosion by stream. Unplanned cutting of slope
37	**Remedial measures**	:	Toe support by concrete measures. Proper drainage arrangements. Material at slope should not be removed, along with plantation along the slope.
38	**Remarks, if any**	:	Multiple slides all along the stream- second order stream. Joined meta argillite
39	**Photo**	:	
40	**Summary/ Abstract**	:	The landslide has occurred by erosion of the toe of the slope by the stream flowing at the base. During rainfall, the water flow tends to become turbulent causing the river to erode its banks
41	**Date of Reporting**	:	17.02.2020
42	**Landslide Category**	:	3

	Field	:	Description
	Location No	:	556
1	**Slide No**	:	103
2	**State**	:	Karnataka
3	**District**	:	Uttara Kannada
4	**Toposheet**	:	48J/09
5	**Name of Slide**	:	KAR/UK/48J09/2019/103
6	**NH/SH/Locality**	:	Jajjigudda village
7	**Latitude**	:	14° 45' 14.592" N
8	**Longitude**	:	74° 41' 45.515" E
9	**Length**	:	8m
10	**Width**	:	20m
11	**Height**	:	6m
12	**Area**	:	160 sq.m
13	**Depth**	:	3
14	**Volume**	:	480
15	**Run out Distance**	:	1m
16	**Type of Material**	:	Debris
17	**Type of Movement**	:	Slide
18	**Rate of movement**	:	Moderate
19	**Activity**	:	Suspended
20	**Distribution**	:	Widening
21	**Style**	:	Multiple
22	**Failure Mechanism**	:	Shallow Planar Failure
23	**History**	:	August-Sept 2019
24	**Geomorphology**	:	Moderately dissected
25	**Geology/ Lithology**	:	Soil covered
26	**Structure**	:	Nil
27	**Land use/ Land Cover**	:	Moderate vegetation
28	**Hydrological condition**	:	Dry
29	**Triggering factor**	:	Rainfall
30	**Death of persons**	:	Nil
31	**People affected**	:	Nil
32	**Livestock loss**	:	Nil

33	**Communication**	:	Road
34	**Infrastructure**	:	Nil
35	**Agriculture/ Forest/ Barren**	:	Forest
36	**Geo-scientific causes**	:	Unplanned cutting of slope for road
37	**Remedial measures**	:	Toe support by concrete measures. Proper drainage arrangements to be given along with plantation along the slope.
38	**Remarks, if any**	:	
39	**Photo**	:	
40	**Summary/ Abstract**	:	The slope failure occurred due to unscientific cutting of slope for construction of roads. The slope gradient is very high and there is thick vegetation on the upper slopes, making it susceptible to failure.
41	**Date of Reporting**	:	18.02.2020
42	**Landslide Category**	:	1

	Field	:	Description
	Location No	:	558
1	**Slide No**	:	104
2	**State**	:	Karnataka
3	**District**	:	Uttara Kannada
4	**Toposheet**	:	48J/09
5	**Name of Slide**	:	KAR/UK/48J109/2019/104
6	**NH/SH/Locality**	:	Tulageri Village
7	**Latitude**	:	14° 45' 17.975" N
8	**Longitude**	:	74° 41' 31.229" E
9	**Length**	:	10m
10	**Width**	:	100m
11	**Height**	:	8m
12	**Area**	:	1000 sq.m
13	**Depth**	:	5
14	**Volume**	:	5000 cu.m
15	**Run out Distance**	:	1m
16	**Type of Material**	:	Debris
17	**Type of Movement**	:	Slide
18	**Rate of movement**	:	Moderate
19	**Activity**	:	Suspended
20	**Distribution**	:	Advancing
21	**Style**	:	Multiple
22	**Failure Mechanism**	:	Deep Planar Failure
23	**History**	:	2019 Monsoon
24	**Geomorphology**	:	Moderately dissected
25	**Geology/ Lithology**	:	Meta-phyllite
26	**Structure**	:	Nil
27	**Land use/ Land Cover**	:	Cultivation
28	**Hydrological condition**	:	Wet
29	**Triggering factor**	:	Rainfall
30	**Death of persons**	:	Nil
31	**People affected**	:	Yes
32	**Livestock loss**	:	Nil
33	**Communication**	:	Nil
34	**Infrastructure**	:	Nil
35	**Agriculture/ Forest/ Barren**	:	Agriculture/Forest
36	**Geo-scientific causes**	:	Toe erosion by stream. Unplanned cutting of slope

37	**Remedial measures**	:	Proper distribution and maintenance of drainage. Toe support at failed places
38	**Remarks, if any**	:	Nil
39	**Photo**	:	
40	**Summary/ Abstract**	:	Extensive cultivation is prevalent along the slopes of these villages. Areca nut and banana are being extensively cultivated and the slopes have been modified for the same. Many times, the soil is taken by cutting the slopes unscientifically, leaving behind steep cuts. The natural course of the smaller streams has also been shifted to one side of the cultivated land. Along the stream, toe erosion is prevalent, leading to slope failure. Multiple slides are observed along a stretch of 50-75 metre of the slope.
41	**Date of Reporting**	:	18.02.2020
42	**Landslide Category**	:	1

	Field	:	Description
	Location No	:	559
1	**Slide No**	:	105
2	**State**	:	Karnataka
3	**District**	:	Uttara Kannada
4	**Toposheet**	:	48J/09
5	**Name of Slide**	:	KAR/UK/48J14/2019/105
6	**NH/SH/Locality**	:	Tulageri Village
7	**Latitude**	:	14° 45' 14.626" N
8	**Longitude**	:	74° 41' 34.967" E
9	**Length**	:	10m
10	**Width**	:	30m
11	**Height**	:	8m
12	**Area**	:	300 sq.m
13	**Depth**	:	2m
14	**Volume**	:	600 cu.m
15	**Run out Distance**	:	2m
16	**Type of Material**	:	Debris
17	**Type of Movement**	:	Slide
18	**Rate of movement**	:	Moderate
19	**Activity**	:	Suspended
20	**Distribution**	:	Widening
21	**Style**	:	Multiple
22	**Failure Mechanism**	:	Deep Planar Failure
23	**History**	:	2019 Monsoon
24	**Geomorphology**	:	Moderately dissected
25	**Geology/ Lithology**	:	Meta-phyllite
26	**Structure**	:	Nil
27	**Land use/ Land Cover**	:	Settlement
28	**Hydrological condition**	:	Wet
29	**Triggering factor**	:	Rainfall
30	**Death of persons**	:	Nil
31	**People affected**	:	Yes
32	**Livestock loss**	:	Yes
33	**Communication**	:	Road
34	**Infrastructure**	:	House
35	**Agriculture/ Forest/ Barren**	:	Nil

36	**Geo-scientific causes**	:	Pulverized material on slope
37	**Remedial measures**	:	Slope nailing. Toe support with back filling. Proper drainage arrangements
38	**Remarks, if any**	:	Pulverized material and gouge formation on steep slopes, indicating fault zone. Springs also present.
39	**Photo**	:	
40	**Summary/ Abstract**	:	. The cut slopes are very steep, and composed of similar pulverized rock, gouge and highly lateralized material making it susceptible to failure. Settlements are located in the vicinity of these failed slopes. Most of the debris from the slides lie very near the houses, making it highly risky for the people to continue staying in them.
41	**Date of Reporting**	:	18.02.2020
42	**Landslide Category**	:	1

	Field	:	Description
	Location No	:	563
1	**Slide No**	:	106
2	**State**	:	Karnataka
3	**District**	:	Uttara Kannada
4	**Toposheet**	:	48J/14
5	**Name of Slide**	:	KAR/UK/48J14/2019/106
6	**NH/SH/Locality**	:	Shelur village
7	**Latitude**	:	14° 30' 37.359" N
8	**Longitude**	:	74° 52' 30.776" E
9	**Length**	:	5m
10	**Width**	:	10m
11	**Height**	:	4m
12	**Area**	:	50 sq.m
13	**Depth**	:	1m
14	**Volume**	:	50 cu.m
15	**Run out Distance**	:	1m
16	**Type of Material**	:	Debris
17	**Type of Movement**	:	Slide
18	**Rate of movement**	:	Moderate
19	**Activity**	:	Reactivated
20	**Distribution**	:	Widening, Advancing
21	**Style**	:	Single
22	**Failure Mechanism**	:	Shallow Planar Failure
23	**History**	:	Old slide
24	**Geomorphology**	:	Moderately dissected
25	**Geology/ Lithology**	:	Soil covered
26	**Structure**	:	Nil
27	**Land use/ Land Cover**	:	Moderate vegetation
28	**Hydrological condition**	:	Dry
29	**Triggering factor**	:	Rainfall
30	**Death of persons**	:	Nil
31	**People affected**	:	Nil
32	**Livestock loss**	:	Nil
33	**Communication**	:	Road
34	**Infrastructure**	:	Nil
35	**Agriculture/ Forest/ Barren**	:	Forest

36	**Geo-scientific causes**	:	Unplanned cutting of slope
37	**Remedial measures**	:	Toe support by appropriate measures. Proper drainage arrangement to be given
38	**Remarks, if any**	:	Nil
39	**Photo**	:	
40	**Summary/ Abstract**	:	The slope failure occurred due to unscientific cutting of slope for construction of roads. The slope gradient is very high and there is thick vegetation on the upper slopes, making it susceptible to failure.
41	**Date of Reporting**	:	19.02.2020
42	**Landslide Category**	:	3

	Field	:	Description
	Location No	:	564
1	**Slide No**	:	107
2	**State**	:	Karnataka
3	**District**	:	Uttara Kannada
4	**Toposheet**	:	48J/14
5	**Name of Slide**	:	KAR/UK/48J14/2019/107
6	**NH/SH/Locality**	:	Kudlemane village
7	**Latitude**	:	14° 31' 6.484" N
8	**Longitude**	:	74° 52' 57.819" E
9	**Length**	:	8m
10	**Width**	:	100m
11	**Height**	:	5m
12	**Area**	:	800 sq.m
13	**Depth**	:	2m
14	**Volume**	:	1600 cu.m
15	**Run out Distance**	:	1m
16	**Type of Material**	:	Dedris
17	**Type of Movement**	:	Slide
18	**Rate of movement**	:	Moderate
19	**Activity**	:	Suspended
20	**Distribution**	:	Widening
21	**Style**	:	Single
22	**Failure Mechanism**	:	Shallow Planar Failure
23	**History**	:	Monsoon 2019
24	**Geomorphology**	:	Lowly dissected
25	**Geology/ Lithology**	:	Argillite with intruded veins
26	**Structure**	:	Nil
27	**Land use/ Land Cover**	:	Sparse vegetation
28	**Hydrological condition**	:	Dry
29	**Triggering factor**	:	Rainfall
30	**Death of persons**	:	Nil
31	**People affected**	:	Nil
32	**Livestock loss**	:	Nil
33	**Communication**	:	Nil
34	**Infrastructure**	:	Nil
35	**Agriculture/ Forest/ Barren**	:	Forest

36	**Geo-scientific causes**	:	Toe erosion by stream
37	**Remedial measures**	:	Toe support by appropriate measures. Gabion wall may be given
38	**Remarks, if any**	:	
39	**Photo**	:	
40	**Summary/ Abstract**	:	The landslide has occurred by erosion of the toe of the slope by the stream flowing at the base. During rainfall, the water flow tends to become turbulent causing the river to erode its banks
41	**Date of Reporting**	:	19.02.2020
42	**Landslide Category**	:	3

	Field	:	Description
	Location No	:	567
1	**Slide No**	:	108
2	**State**	:	Karnataka
3	**District**	:	Uttara Kannada
4	**Toposheet**	:	48J/14
5	**Name of Slide**	:	KAR/UK/48J14/2019/108
6	**NH/SH/Locality**	:	Kulave village
7	**Latitude**	:	14° 34' 10.552" N
8	**Longitude**	:	74° 51' 20.967" E
9	**Length**	:	8m
10	**Width**	:	40m
11	**Height**	:	5m
12	**Area**	:	320 sq.m
13	**Depth**	:	1m
14	**Volume**	:	320 cu.m
15	**Run out Distance**	:	1m
16	**Type of Material**	:	Soil
17	**Type of Movement**	:	Slide
18	**Rate of movement**	:	Moderate
19	**Activity**	:	Suspended
20	**Distribution**	:	Widening, Advancing
21	**Style**	:	Multiple
22	**Failure Mechanism**	:	Shallow Planar Failure
23	**History**	:	Old slide
24	**Geomorphology**	:	Lowly dissected
25	**Geology/ Lithology**	:	Soil covered
26	**Structure**	:	Nil
27	**Land use/ Land Cover**	:	Cultivation, Forest
28	**Hydrological condition**	:	Dry
29	**Triggering factor**	:	Rainfall
30	**Death of persons**	:	Nil
31	**People affected**	:	Nil
32	**Livestock loss**	:	Nil
33	**Communication**	:	Foot track
34	**Infrastructure**	:	Nil
35	**Agriculture/ Forest/ Barren**	:	Agriculture, Forest

36	**Geo-scientific causes**	:	Toe erosion by stream
37	**Remedial measures**	:	Toe support by appropriate measures
38	**Remarks, if any**	:	Gravel bed observed on left bank of stream
39	**Photo**	:	
40	**Summary/ Abstract**	:	The landslide has occurred by erosion of the toe of the slope by the stream flowing at the base. During rainfall, the water flow tends to become turbulent causing the river to erode its banks
41	**Date of Reporting**	:	20.02.2020
42	**Landslide Category**	:	3

	Field	:	Description
	Location No	:	568
1	**Slide No**	:	109
2	**State**	:	Karnataka
3	**District**	:	Uttara Kannada
4	**Toposheet**	:	48J/14
5	**Name of Slide**	:	KAR/UK/48J14/2019/109
6	**NH/SH/Locality**	:	Tarkanalli village
7	**Latitude**	:	14° 34' 38.771" N
8	**Longitude**	:	74° 52' 6.417" E
9	**Length**	:	20m
10	**Width**	:	200m
11	**Height**	:	12m
12	**Area**	:	4000 sq.m
13	**Depth**	:	2m
14	**Volume**	:	8000 cu.m
15	**Run out Distance**	:	3m
16	**Type of Material**	:	Debris
17	**Type of Movement**	:	Slide
18	**Rate of movement**	:	Moderate
19	**Activity**	:	Suspended
20	**Distribution**	:	Widening, Advancing
21	**Style**	:	Multiple
22	**Failure Mechanism**	:	Deep Planar Failure
23	**History**	:	Old slide
24	**Geomorphology**	:	Lowly dissected
25	**Geology/ Lithology**	:	Meta argillite
26	**Structure**	:	Nil
27	**Land use/ Land Cover**	:	Sparse vegetation
28	**Hydrological condition**	:	Dry
29	**Triggering factor**	:	Rainfall
30	**Death of persons**	:	Nil
31	**People affected**	:	Nil
32	**Livestock loss**	:	Nil
33	**Communication**	:	Nil
34	**Infrastructure**	:	Nil
35	**Agriculture/ Forest/ Barren**	:	Agriculture
36	**Geo-scientific causes**	:	Toe erosion by stream.

37	**Remedial measures**	:	Avoid removal of toe material. Proper toe support by concrete measures. Avoid blockage of drainage.
38	**Remarks, if any**	:	
39	**Photo**	:	
40	**Summary/ Abstract**	:	The landslide has occurred by erosion of the toe of the slope by the stream flowing at the base. During rainfall, the water flow tends to become turbulent causing the river to erode its banks
41	**Date of Reporting**	:	20.02.2020
42	**Landslide Category**	:	3

	Field	:	Description
	Location No	:	570
1	**Slide No**	:	110
2	**State**	:	Karnataka
3	**District**	:	Uttara Kannada
4	**Toposheet**	:	48J/14
5	**Name of Slide**	:	KAR/UK/48J14/2019/110
6	**NH/SH/Locality**	:	Marathekoppa village
7	**Latitude**	:	14° 33' 47.158" N
8	**Longitude**	:	74° 52' 37.331" E
9	**Length**	:	10m
10	**Width**	:	50m
11	**Height**	:	6m
12	**Area**	:	500 sq.m
13	**Depth**	:	2m
14	**Volume**	:	1000 cu.m
15	**Run out Distance**	:	1m
16	**Type of Material**	:	Soil
17	**Type of Movement**	:	Slide
18	**Rate of movement**	:	Moderate
19	**Activity**	:	Suspended
20	**Distribution**	:	Widening, Advancing
21	**Style**	:	Multiple
22	**Failure Mechanism**	:	Shallow Planar Failure
23	**History**	:	Old slide
24	**Geomorphology**	:	Lowly dissected
25	**Geology/ Lithology**	:	Soil covered
26	**Structure**	:	Nil
27	**Land use/ Land Cover**	:	Moderate vegetation
28	**Hydrological condition**	:	Dry
29	**Triggering factor**	:	Rainfall
30	**Death of persons**	:	Nil
31	**People affected**	:	Nil
32	**Livestock loss**	:	Nil
33	**Communication**	:	Nil
34	**Infrastructure**	:	Nil
35	**Agriculture/ Forest/ Barren**	:	Forest
36	**Geo-scientific causes**	:	Toe erosion by stream.

37	**Remedial measures**	:	Toe support by appropriate measures. Planation to be given on slope
38	**Remarks, if any**	:	Nil
39	**Photo**	:	
40	**Summary/ Abstract**	:	The landslide has occurred by erosion of the toe of the slope by the stream flowing at the base. During rainfall, the water flow tends to become turbulent causing the river to erode its banks
41	**Date of Reporting**	:	21.02.2020
42	**Landslide Category**	:	3

	Field	:	Description
	Location No	:	573
1	**Slide No**	:	111
2	**State**	:	Karnataka
3	**District**	:	Uttara Kannada
4	**Toposheet**	:	48J/14
5	**Name of Slide**	:	KAR/UK/48J14/2019/111
6	**NH/SH/Locality**	:	East of Mulgol village
7	**Latitude**	:	14° 42' 32.021" N
8	**Longitude**	:	74° 49' 50.857" E
9	**Length**	:	10m
10	**Width**	:	30m
11	**Height**	:	8m
12	**Area**	:	300 sq.m
13	**Depth**	:	1m
14	**Volume**	:	300 cu.m
15	**Run out Distance**	:	2m
16	**Type of Material**	:	Debris
17	**Type of Movement**	:	Slide
18	**Rate of movement**	:	Moderate
19	**Activity**	:	Reactivated
20	**Distribution**	:	Widening, Advancing
21	**Style**	:	Multiple
22	**Failure Mechanism**	:	Shallow Planar Failure
23	**History**	:	Old slide due to ECS
24	**Geomorphology**	:	Lowly dissected
25	**Geology/ Lithology**	:	Meta argillite
26	**Structure**	:	Jointed
27	**Land use/ Land Cover**	:	Cultivation
28	**Hydrological condition**	:	Dry
29	**Triggering factor**	:	Rainfall
30	**Death of persons**	:	Nil
31	**People affected**	:	Nil
32	**Livestock loss**	:	Nil
33	**Communication**	:	Nil
34	**Infrastructure**	:	Nil
35	**Agriculture/ Forest/ Barren**	:	Agriculture

36	**Geo-scientific causes**	:	Loading at Head
37	**Remedial measures**	:	Avoid extensive cut slope. Proper toe support to stabilize the slope. Proper drainage arrangement. Minimize head load. Plantation may be given on slope
38	**Remarks, if any**	:	Nil
39	**Photo**	:	
40	**Summary/ Abstract**	:	The slope has failed due to presence of thick vegetation on the crown. The head loading, combined with unscientific cutting of slope has led to failure.
41	**Date of Reporting**	:	22.02.2020
42	**Landslide Category**	:	3

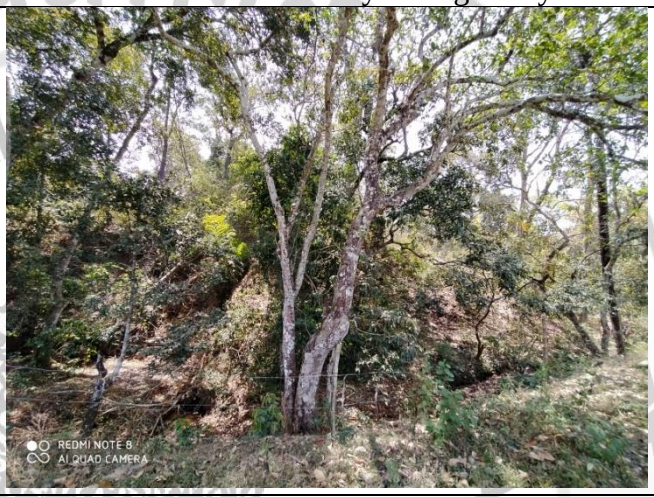
	Field	:	Description
	Location No	:	576a
1	**Slide No**	:	112
2	**State**	:	Karnataka
3	**District**	:	Uttara Kannada
4	**Toposheet**	:	48J/14
5	**Name of Slide**	:	KAR/UK/48J14/2019/112
6	**NH/SH/Locality**	:	Belale village
7	**Latitude**	:	14° 42' 44.486" N
8	**Longitude**	:	74° 50' 23.691" E
9	**Length**	:	12m
10	**Width**	:	200m
11	**Height**	:	8m
12	**Area**	:	2400 sq.m
13	**Depth**	:	2m
14	**Volume**	:	4800 cu.m
15	**Run out Distance**	:	3m
16	**Type of Material**	:	Soil
17	**Type of Movement**	:	Slide
18	**Rate of movement**	:	Moderate
19	**Activity**	:	Suspended
20	**Distribution**	:	Widening, Advancing
21	**Style**	:	Multiple
22	**Failure Mechanism**	:	Shallow Planar Failure
23	**History**	:	Monsoon 2019
24	**Geomorphology**	:	Lowly dissected
25	**Geology/ Lithology**	:	Meta argillite
26	**Structure**	:	Jointed
27	**Land use/ Land Cover**	:	ECS, Modertae vegetation
28	**Hydrological condition**	:	Flowing
29	**Triggering factor**	:	Rainfall
30	**Death of persons**	:	Nil
31	**People affected**	:	Nil
32	**Livestock loss**	:	Nil
33	**Communication**	:	Nil
34	**Infrastructure**	:	Nil
35	**Agriculture/ Forest/ Barren**	:	Agriculture

36	**Geo-scientific causes**	:	Toe erosion by stream. Loading at Head
37	**Remedial measures**	:	Avoid removal of toe material. Proper Drainage arrangements. Proper toe support by concrete measures. Avoid blockage of drainage. Minimize slope gradient with plantation
38	**Remarks, if any**	:	Nil
39	**Photo**	:	
40	**Summary/ Abstract**	:	The landslide has occurred by erosion of the toe of the slope by the stream flowing at the base. During rainfall, the water flow tends to become turbulent causing the river to erode its banks
41	**Date of Reporting**	:	22.02.2020
42	**Landslide Category**	:	3

	Field	:	Description
	Location No	:	579
1	**Slide No**	:	113
2	**State**	:	Karnataka
3	**District**	:	Uttara Kannada
4	**Toposheet**	:	48J/14
5	**Name of Slide**	:	KAR/UK/48J14/2019/113
6	**NH/SH/Locality**	:	Bailgadde village
7	**Latitude**	:	14° 43' 46.063" N
8	**Longitude**	:	74° 52' 57.562" E
9	**Length**	:	10m
10	**Width**	:	15m
11	**Height**	:	9m
12	**Area**	:	150 sq.m
13	**Depth**	:	2m
14	**Volume**	:	NA
15	**Run out Distance**	:	2m
16	**Type of Material**	:	Soil
17	**Type of Movement**	:	Flow
18	**Rate of movement**	:	Rapid
19	**Activity**	:	Suspended
20	**Distribution**	:	Confined
21	**Style**	:	Single
22	**Failure Mechanism**	:	Shallow Planar Failure
23	**History**	:	Monsoon 2019
24	**Geomorphology**	:	Moderately dissected
25	**Geology/ Lithology**	:	Doleite dyke
26	**Structure**	:	Jointed
27	**Land use/ Land Cover**	:	Moderate vegetation, Cultivation
28	**Hydrological condition**	:	Flowing
29	**Triggering factor**	:	Rainfall
30	**Death of persons**	:	Nil
31	**People affected**	:	Nil
32	**Livestock loss**	:	Nil
33	**Communication**	:	Nil
34	**Infrastructure**	:	Nil
35	**Agriculture/ Forest/ Barren**	:	Nil
36	**Geo-scientific causes**	:	Toe erosion by stream, Gully erosion

37	**Remedial measures**	:	Plantation and proper drainage arrangement. Toe support by appropriate measures
38	**Remarks, if any**	:	A gravel bed is observed within the slope of the banks. The pebbles are sub rounded to elongate in shape, indicating transportation. The bed is about 1 foot thick.
39	**Photo**	:	
40	**Summary/ Abstract**	:	The landslide has occurred by erosion of the toe of the slope by the stream flowing at the base. During rainfall, the water flow tends to become turbulent causing the river to erode its banks
41	**Date of Reporting**	:	25.02.2020
42	**Landslide Category**	:	3

	Field	:	Description
	Location No	:	580
1	**Slide No**	:	114
2	**State**	:	Karnataka
3	**District**	:	Uttara Kannada
4	**Toposheet**	:	48J/14
5	**Name of Slide**	:	KAR/UK/48J14/2019/114
6	**NH/SH/Locality**	:	Bailgadde village
7	**Latitude**	:	14° 43' 36.885" N
8	**Longitude**	:	74° 53' 11.898" E
9	**Length**	:	8m
10	**Width**	:	15m
11	**Height**	:	5m
12	**Area**	:	120 sq.m
13	**Depth**	:	1m
14	**Volume**	:	120 cu.m
15	**Run out Distance**	:	1m
16	**Type of Material**	:	Soil
17	**Type of Movement**	:	Slide
18	**Rate of movement**	:	Rapid
19	**Activity**	:	Suspended
20	**Distribution**	:	Widening
21	**Style**	:	Multiple
22	**Failure Mechanism**	:	Deep Planar Failure
23	**History**	:	Old
24	**Geomorphology**	:	Moderately dissected
25	**Geology/ Lithology**	:	Soil covered
26	**Structure**	:	Nil
27	**Land use/ Land Cover**	:	Moderate vegetation, Cultivation
28	**Hydrological condition**	:	Wet
29	**Triggering factor**	:	Rainfall
30	**Death of persons**	:	Nil
31	**People affected**	:	Nil
32	**Livestock loss**	:	Nil
33	**Communication**	:	Nil
34	**Infrastructure**	:	Nil

35	**Agriculture/ Forest/ Barren**	:	Forest
36	**Geo-scientific causes**	:	Reduction of strength on super saturation
37	**Remedial measures**	:	Provide perforated pipes into slope material to drain out the infiltrated water during rainfall
38	**Remarks, if any**	:	Slope material comprises of clay which doesn't allow water to infiltrate and drain away during heavy rainfall.
39	**Photo**	:	
40	**Summary/ Abstract**	:	The landslide occurred due to reduction of strength of slope on super saturation. The clayey material forming the slope forms an impervious layer, thereby constricting the movement of water. This leads to increase in pore water pressure causing slope to fail.
41	**Date of Reporting**	:	25.02.2020
42	**Landslide Category**	:	3

	Field	:	Description
	Location No	:	583
1	**Slide No**	:	115
2	**State**	:	Karnataka
3	**District**	:	Uttara Kannada
4	**Toposheet**	:	48J/13
5	**Name of Slide**	:	KAR/UK/48J13/2019/115
6	**NH/SH/Locality**	:	Kundargi village
7	**Latitude**	:	14° 46' 43.590" N
8	**Longitude**	:	74° 52' 41.813" E
9	**Length**	:	6m
10	**Width**	:	80m
11	**Height**	:	4m
12	**Area**	:	480 sq.m
13	**Depth**	:	1.5m
14	**Volume**	:	720
15	**Run out Distance**	:	2m
16	**Type of Material**	:	Debris
17	**Type of Movement**	:	Slide
18	**Rate of movement**	:	Moderate
19	**Activity**	:	Suspended
20	**Distribution**	:	Advancing
21	**Style**	:	Single
22	**Failure Mechanism**	:	Shallow Planar Failure
23	**History**	:	Monsoon 2019
24	**Geomorphology**	:	Moderately dissected
25	**Geology/ Lithology**	:	Meta argillite
26	**Structure**	:	Nil
27	**Land use/ Land Cover**	:	Moderate vegetation, Cultivation
28	**Hydrological condition**	:	Flowing
29	**Triggering factor**	:	Rainfall
30	**Death of persons**	:	Nil
31	**People affected**	:	Nil
32	**Livestock loss**	:	Nil
33	**Communication**	:	Nil
34	**Infrastructure**	:	Nil
35	**Agriculture/ Forest/ Barren**	:	Agriculture/ Forest

36	**Geo-scientific causes**	:	Toe erosion by stream. Loading at Head
37	**Remedial measures**	:	Avoid removal of slided material from toe portion. Provide toe support by appropriate measures. Proper drainage arrangement. Stream blockage to be avoided. Minimize head load
38	**Remarks, if any**	:	Nil
39	**Photo**	:	
40	**Summary/ Abstract**	:	The landslide has occurred by erosion of the toe of the slope by the stream flowing at the base. During rainfall, the water flow tends to become turbulent causing the river to erode its banks
41	**Date of Reporting**	:	26.02.2020
42	**Landslide Category**	:	3

	Field	:	Description
	Location No	:	590
1	**Slide No**	:	116
2	**State**	:	Karnataka
3	**District**	:	Uttara Kannada
4	**Toposheet**	:	48J/14
5	**Name of Slide**	:	KAR/UK/48J14/2019/116
6	**NH/SH/Locality**	:	Ajibail village
7	**Latitude**	:	14° 32' 16.779" N
8	**Longitude**	:	74° 49' 49.784" E
9	**Length**	:	5m
10	**Width**	:	10m
11	**Height**	:	4m
12	**Area**	:	50 sq.m
13	**Depth**	:	1m
14	**Volume**	:	50 cu.m
15	**Run out Distance**	:	1.00
16	**Type of Material**	:	Debris
17	**Type of Movement**	:	Slide
18	**Rate of movement**	:	Moderate
19	**Activity**	:	Suspended
20	**Distribution**	:	Confined
21	**Style**	:	Single
22	**Failure Mechanism**	:	Shallow Planar Failure
23	**History**	:	Monsoon 2019
24	**Geomorphology**	:	Lowly dissected
25	**Geology/ Lithology**	:	Meta argillite with quartz vein
26	**Structure**	:	Nil
27	**Land use/ Land Cover**	:	ECS, Followed by anthropogenic activity
28	**Hydrological condition**	:	Dry
29	**Triggering factor**	:	Rainfall
30	**Death of persons**	:	Nil
31	**People affected**	:	Nil
32	**Livestock loss**	:	Nil
33	**Communication**	:	Nil
34	**Infrastructure**	:	Nil
35	**Agriculture/ Forest/ Barren**	:	Barren

36	**Geo-scientific causes**	:	unplanned cutting of slope
37	**Remedial measures**	:	Avoid ECS and Removal of slided material. Toe support by appropriate measures
38	**Remarks, if any**	:	Nil
39	**Photo**	:	
40	**Summary/ Abstract**	:	The slope failure occurred due to unscientific cutting of slope for cultivation. The slope gradient is very high making it susceptible to failure.
41	**Date of Reporting**	:	02.03.2020
42	**Landslide Category**	:	3

	Field	:	Description
	Location No	:	592
1	**Slide No**	:	117
2	**State**	:	Karnataka
3	**District**	:	Uttara Kannada
4	**Toposheet**	:	48J/14
5	**Name of Slide**	:	KAR/UK/48J14/2019/117
6	**NH/SH/Locality**	:	Misgundli village
7	**Latitude**	:	14° 32' 14.784" N
8	**Longitude**	:	74° 50' 17.985" E
9	**Length**	:	8m
10	**Width**	:	30m
11	**Height**	:	6m
12	**Area**	:	240 sq.m
13	**Depth**	:	1m
14	**Volume**	:	240
15	**Run out Distance**	:	2m
16	**Type of Material**	:	Debris
17	**Type of Movement**	:	Slide
18	**Rate of movement**	:	Moderate
19	**Activity**	:	Suspended
20	**Distribution**	:	Widening
21	**Style**	:	Multiple
22	**Failure Mechanism**	:	Shallow Planar Failure
23	**History**	:	Monsoon 2019
24	**Geomorphology**	:	Lowly dissected
25	**Geology/ Lithology**	:	Laterite
26	**Structure**	:	
27	**Land use/ Land Cover**	:	Cultivation with settlement
28	**Hydrological condition**	:	Dry
29	**Triggering factor**	:	Rainfall
30	**Death of persons**	:	Nil
31	**People affected**	:	Nil
32	**Livestock loss**	:	Nil
33	**Communication**	:	Nil
34	**Infrastructure**	:	Nil
35	**Agriculture/ Forest/ Barren**	:	Agriculture
36	**Geo-scientific causes**	:	Unplanned cutting of slope. Loading at head region

37	**Remedial measures**	:	Avoid removal of slide debris. Give proper drainage arrangement. Avoid cutting of slopes
38	**Remarks, if any**	:	Nil
39	**Photo**	:	
40	**Summary/ Abstract**	:	The slope failure occurred due to unscientific cutting of slope for cultivation. The slope gradient is very high making it susceptible to failure.
41	**Date of Reporting**	:	02.03.2020
42	**Landslide Category**	:	3

	Field	:	Description
	Location No	:	596
1	**Slide No**	:	118
2	**State**	:	Karnataka
3	**District**	:	Uttara Kannada
4	**Toposheet**	:	48J/14
5	**Name of Slide**	:	KAR/UK/48J14/2019/118
6	**NH/SH/Locality**	:	Gattikai village
7	**Latitude**	:	14° 31' 43.643" N
8	**Longitude**	:	74° 50' 48.652" E
9	**Length**	:	15m
10	**Width**	:	25m
11	**Height**	:	10m
12	**Area**	:	375 sq.m
13	**Depth**	:	2m
14	**Volume**	:	750 cu.m
15	**Run out Distance**	:	3m
16	**Type of Material**	:	Soil
17	**Type of Movement**	:	Slide
18	**Rate of movement**	:	Moderate
19	**Activity**	:	Reactivated
20	**Distribution**	:	Widening
21	**Style**	:	Multiple
22	**Failure Mechanism**	:	Deep Planar Failure
23	**History**	:	Old slide
24	**Geomorphology**	:	Lowly dissected
25	**Geology/ Lithology**	:	Argillite with laterite cappings
26	**Structure**	:	Jointed
27	**Land use/ Land Cover**	:	Cultivation/ Forest
28	**Hydrological condition**	:	Dry
29	**Triggering factor**	:	Rainfall
30	**Death of persons**	:	Nil
31	**People affected**	:	Nil
32	**Livestock loss**	:	Nil

33	**Communication**	:	Nil
34	**Infrastructure**	:	Nil
35	**Agriculture/ Forest/ Barren**	:	Agriculture
36	**Geo-scientific causes**	:	Toe erosion by stream. Unplanned cutting of slope
37	**Remedial measures**	:	Avoid removal of slide debris and toe of slope. Give proper drainage arrangement. Toe support and benching of slope
38	**Remarks, if any**	:	
39	**Photo**	:	
40	**Summary/ Abstract**	:	The landslide has occurred by erosion of the toe of the slope by the stream flowing at the base. During rainfall, the water flow tends to become turbulent causing the river to erode its banks. Along with the weathered material, vegetation and rock fragments have also slided along the slope. Joint 275/70 is trending parallel to the stream. These joints allow water percolation, thereby easily weathering the rock. Sliding along joint surface.
41	**Date of Reporting**	:	03.03.2020
42	**Landslide Category**	:	3

	Field	:	Description
	Location No	:	597
1	**Slide No**	:	119
2	**State**	:	Karnataka
3	**District**	:	Uttara Kannada
4	**Toposheet**	:	48J/14
5	**Name of Slide**	:	KAR/UK/48J14/2019/119
6	**NH/SH/Locality**	:	Iragoppa village
7	**Latitude**	:	14° 31' 30.195" N
8	**Longitude**	:	74° 50' 43.929" E
9	**Length**	:	10m
10	**Width**	:	30m
11	**Height**	:	8m
12	**Area**	:	300 sq.m
13	**Depth**	:	1
14	**Volume**	:	300 cu.m
15	**Run out Distance**	:	2.00
16	**Type of Material**	:	Soil
17	**Type of Movement**	:	Slide
18	**Rate of movement**	:	Moderate
19	**Activity**	:	Suspended
20	**Distribution**	:	Widening
21	**Style**	:	Single
22	**Failure Mechanism**	:	Shallow Planar Failure
23	**History**	:	Monsoon 2019
24	**Geomorphology**	:	Lowly dissected
25	**Geology/ Lithology**	:	Soil covered
26	**Structure**	:	Nil
27	**Land use/ Land Cover**	:	Forest
28	**Hydrological condition**	:	Dry
29	**Triggering factor**	:	Rainfall
30	**Death of persons**	:	Nil
31	**People affected**	:	Nil
32	**Livestock loss**	:	Nil
33	**Communication**	:	Nil

34	**Infrastructure**	:	Nil
35	**Agriculture/ Forest/ Barren**	:	Forest
36	**Geo-scientific causes**	:	Reduction of strength on super saturation. Unplanned cutting of slope
37	**Remedial measures**	:	Avoid removal of slided material from toe. Toe support by appropriate measures and proper drainage management
38	**Remarks, if any**	:	Nil
39	**Photo**	:	
40	**Summary/ Abstract**	:	The slope failure occurred due to unscientific cutting of slope for cultivation. The slope gradient is very high making it susceptible to failure.
41	**Date of Reporting**	:	03.03.2020
42	**Landslide Category**	:	3

	Field	:	Description
	Location No	:	607
1	**Slide No**	:	120
2	**State**	:	Karnataka
3	**District**	:	Uttara Kannada
4	**Toposheet**	:	48J/14
5	**Name of Slide**	:	KAR/UK/48J14/2019/120
6	**NH/SH/Locality**	:	Sappurti village
7	**Latitude**	:	14° 31' 39.766" N
8	**Longitude**	:	74° 45' 22.843" E
9	**Length**	:	20m
10	**Width**	:	500m
11	**Height**	:	18m
12	**Area**	:	10000 sq.m
13	**Depth**	:	2
14	**Volume**	:	20000
15	**Run out Distance**	:	2m
16	**Type of Material**	:	Soil
17	**Type of Movement**	:	Slide
18	**Rate of movement**	:	Moderate
19	**Activity**	:	Suspended
20	**Distribution**	:	Advancing
21	**Style**	:	Multiple
22	**Failure Mechanism**	:	Shallow Planar Failure
23	**History**	:	Old slide
24	**Geomorphology**	:	Lowly dissected
25	**Geology/ Lithology**	:	Soil covered
26	**Structure**	:	Nil
27	**Land use/ Land Cover**	:	Cultivation/ Forest
28	**Hydrological condition**	:	Dry
29	**Triggering factor**	:	Rainfall
30	**Death of persons**	:	Nil
31	**People affected**	:	Nil
32	**Livestock loss**	:	Nil

33	**Communication**	:	Nil
34	**Infrastructure**	:	Nil
35	**Agriculture/ Forest/ Barren**	:	Agriculture/Forest
36	**Geo-scientific causes**	:	Unplanned cutting of slope. Loading at head region
37	**Remedial measures**	:	Avoid removal of slided material from toe portion. Provide toe support by appropriate measures. Proper drainage arrangement. Stream blockage to be avoided. Minimize head load
38	**Remarks, if any**	:	Nil
39	**Photo**	:	
40	**Summary/ Abstract**	:	The slope failure occurred due to unscientific cutting of slope for cultivation. The slope gradient is very high making it susceptible to failure.
41	**Date of Reporting**	:	04.03.2020
42	**Landslide Category**	:	3

	Field	:	Description
	Location No	:	609
1	**Slide No**	:	121
2	**State**	:	Karnataka
3	**District**	:	Uttara Kannada
4	**Toposheet**	:	48J/14
5	**Name of Slide**	:	KAR/UK/48J14/2019/121
6	**NH/SH/Locality**	:	Duminsare village
7	**Latitude**	:	14° 42' 7.540" N
8	**Longitude**	:	74° 54' 28.719" E
9	**Length**	:	6m
10	**Width**	:	30m
11	**Height**	:	5m
12	**Area**	:	180 sq.m
13	**Depth**	:	1m
14	**Volume**	:	180 cu.m
15	**Run out Distance**	:	1m
16	**Type of Material**	:	Soil
17	**Type of Movement**	:	Slide
18	**Rate of movement**	:	Moderate
19	**Activity**	:	Suspended
20	**Distribution**	:	Widening
21	**Style**	:	Single
22	**Failure Mechanism**	:	Shallow Planar Failure
23	**History**	:	Monsoon 2019
24	**Geomorphology**	:	Lowly dissected
25	**Geology/ Lithology**	:	Meta argillite
26	**Structure**	:	Jointed
27	**Land use/ Land Cover**	:	Cultivation, Settlement
28	**Hydrological condition**	:	Dry
29	**Triggering factor**	:	Rainfall
30	**Death of persons**	:	Nil
31	**People affected**	:	Nil
32	**Livestock loss**	:	Nil

33	**Communication**	:	Nil
34	**Infrastructure**	:	Settlement
35	**Agriculture/ Forest/ Barren**	:	Agriculture
36	**Geo-scientific causes**	:	Reduction of strength on super saturation. Toe erosion by stream. Increase in unit mass during rainfall
37	**Remedial measures**	:	Give toe support by appropriate measures. Avoid increase of unit mass of slope by providing proper drainage arrangement. Avoid blockage of drain
38	**Remarks, if any**	:	Nil
39	**Photo**	:	
40	**Summary/ Abstract**	:	The landslide has occurred by erosion of the toe of the slope by the stream flowing at the base. During rainfall, the water flow tends to become turbulent causing the river to erode its banks. Along with the weathered material, vegetation and rock fragments have also slided along the slope.
41	**Date of Reporting**	:	05.03.2020
42	**Landslide Category**	:	3

	Field	:	Description
	Location No	:	620
1	**Slide No**	:	122
2	**State**	:	Karnataka
3	**District**	:	Uttara Kannada
4	**Toposheet**	:	48J/14
5	**Name of Slide**	:	KAR/UK/48J14/2019/122
6	**NH/SH/Locality**	:	Hemmadi village
7	**Latitude**	:	14° 45' 2.533" N
8	**Longitude**	:	74° 51' 29.447" E
9	**Length**	:	12m
10	**Width**	:	20m
11	**Height**	:	10m
12	**Area**	:	240sq.m
13	**Depth**	:	2m
14	**Volume**	:	480cu.m
15	**Run out Distance**	:	1m
16	**Type of Material**	:	Soil
17	**Type of Movement**	:	Slide
18	**Rate of movement**	:	Moderate
19	**Activity**	:	Suspended
20	**Distribution**	:	Widening
21	**Style**	:	Single
22	**Failure Mechanism**	:	Shallow Planar Failure
23	**History**	:	Monsoon 2019
24	**Geomorphology**	:	Moderately dissected
25	**Geology/ Lithology**	:	Meta argillite
26	**Structure**	:	Jointed
27	**Land use/ Land Cover**	:	Forest
28	**Hydrological condition**	:	Dry
29	**Triggering factor**	:	Rainfall
30	**Death of persons**	:	Nil
31	**People affected**	:	Nil

32	**Livestock loss**	:	Nil
33	**Communication**	:	Nil
34	**Infrastructure**	:	Nil
35	**Agriculture/ Forest/ Barren**	:	Forest
36	**Geo-scientific causes**	:	Toe erosion by stream
37	**Remedial measures**	:	Give toe support by appropriate measures to stop erosion of toe.
38	**Remarks, if any**	:	The slide is completely natural.
39	**Photo**	:	
40	**Summary/ Abstract**	:	The landslide has occurred by erosion of the toe of the slope by the stream flowing at the base. During rainfall, the water flow tends to become turbulent causing the river to erode its banks along with the weathered material, vegetation and rock fragments have also slided along the slope.
41	**Date of Reporting**	:	09.03.2020
42	**Landslide Category**	:	3

	Field	:	Description
	Location No	:	607
1	**Slide No**	:	120
2	**State**	:	Karnataka
3	**District**	:	Uttara Kannada
4	**Toposheet**	:	48J/14
5	**Name of Slide**	:	KAR/UK/48J14/2019/120
6	**NH/SH/Locality**	:	Sappurti village
7	**Latitude**	:	14° 31' 39.766" N
8	**Longitude**	:	74° 45' 22.843" E
9	**Length**	:	20m
10	**Width**	:	500m
11	**Height**	:	18m
12	**Area**	:	10000 sq.m
13	**Depth**	:	2
14	**Volume**	:	20000
15	**Run out Distance**	:	2m
16	**Type of Material**	:	Soil
17	**Type of Movement**	:	Slide
18	**Rate of movement**	:	Moderate
19	**Activity**	:	Suspended
20	**Distribution**	:	Advancing
21	**Style**	:	Multiple
22	**Failure Mechanism**	:	Shallow Planar Failure
23	**History**	:	Old slide
24	**Geomorphology**	:	Lowly dissected
25	**Geology/ Lithology**	:	Soil covered
26	**Structure**	:	Nil
27	**Land use/ Land Cover**	:	Cultivation/ Forest
28	**Hydrological condition**	:	Dry
29	**Triggering factor**	:	Rainfall
30	**Death of persons**	:	Nil
31	**People affected**	:	Nil
32	**Livestock loss**	:	Nil

33	**Communication**	:	Nil
34	**Infrastructure**	:	Nil
35	**Agriculture/ Forest/ Barren**	:	Agriculture/Forest
36	**Geo-scientific causes**	:	Unplanned cutting of slope. Loading at head region
37	**Remedial measures**	:	Avoid removal of slided material from toe portion. Provide toe support by appropriate measures. Proper drainage arrangement. Stream blockage to be avoided. Minimize head load
38	**Remarks, if any**	:	Nil
39	**Photo**	:	
40	**Summary/ Abstract**	:	The slope failure occurred due to unscientific cutting of slope for cultivation. The slope gradient is very high making it susceptible to failure.
41	**Date of Reporting**	:	04.03.2020
42	**Landslide Category**	:	3

	Field	:	Description
	Location No	:	609
1	**Slide No**	:	121
2	**State**	:	Karnataka
3	**District**	:	Uttara Kannada
4	**Toposheet**	:	48J/14
5	**Name of Slide**	:	KAR/UK/48J14/2019/121
6	**NH/SH/Locality**	:	Duminsare village
7	**Latitude**	:	14° 42' 7.540" N
8	**Longitude**	:	74° 54' 28.719" E
9	**Length**	:	6m
10	**Width**	:	30m
11	**Height**	:	5m
12	**Area**	:	180 sq.m
13	**Depth**	:	1m
14	**Volume**	:	180 cu.m
15	**Run out Distance**	:	1m
16	**Type of Material**	:	Soil
17	**Type of Movement**	:	Slide
18	**Rate of movement**	:	Moderate
19	**Activity**	:	Suspended
20	**Distribution**	:	Widening
21	**Style**	:	Single
22	**Failure Mechanism**	:	Shallow Planar Failure
23	**History**	:	Monsoon 2019
24	**Geomorphology**	:	Lowly dissected
25	**Geology/ Lithology**	:	Meta argillite
26	**Structure**	:	Jointed
27	**Land use/ Land Cover**	:	Cultivation, Settlement
28	**Hydrological condition**	:	Dry
29	**Triggering factor**	:	Rainfall
30	**Death of persons**	:	Nil
31	**People affected**	:	Nil
32	**Livestock loss**	:	Nil

33	**Communication**	:	Nil
34	**Infrastructure**	:	Settlement
35	**Agriculture/ Forest/ Barren**	:	Agriculture
36	**Geo-scientific causes**	:	Reduction of strength on super saturation. Toe erosion by stream. Increase in unit mass during rainfall
37	**Remedial measures**	:	Give toe support by appropriate measures. Avoid increase of unit mass of slope by providing proper drainage arrangement. Avoid blockage of drain
38	**Remarks, if any**	:	Nil
39	**Photo**	:	
40	**Summary/ Abstract**	:	The landslide has occurred by erosion of the toe of the slope by the stream flowing at the base. During rainfall, the water flow tends to become turbulent causing the river to erode its banks. Along with the weathered material, vegetation and rock fragments have also slided along the slope.
41	**Date of Reporting**	:	05.03.2020
42	**Landslide Category**	:	3

	Field	:	Description
	Location No	:	620
1	**Slide No**	:	122
2	**State**	:	Karnataka
3	**District**	:	Uttara Kannada
4	**Toposheet**	:	48J/14
5	**Name of Slide**	:	KAR/UK/48J14/2019/122
6	**NH/SH/Locality**	:	Hemmadi village
7	**Latitude**	:	14° 45' 2.533" N
8	**Longitude**	:	74° 51' 29.447" E
9	**Length**	:	12m
10	**Width**	:	20m
11	**Height**	:	10m
12	**Area**	:	240sq.m
13	**Depth**	:	2m
14	**Volume**	:	480cu.m
15	**Run out Distance**	:	1m
16	**Type of Material**	:	Soil
17	**Type of Movement**	:	Slide
18	**Rate of movement**	:	Moderate
19	**Activity**	:	Suspended
20	**Distribution**	:	Widening
21	**Style**	:	Single
22	**Failure Mechanism**	:	Shallow Planar Failure
23	**History**	:	Monsoon 2019
24	**Geomorphology**	:	Moderately dissected
25	**Geology/ Lithology**	:	Meta argillite
26	**Structure**	:	Jointed
27	**Land use/ Land Cover**	:	Forest
28	**Hydrological condition**	:	Dry
29	**Triggering factor**	:	Rainfall
30	**Death of persons**	:	Nil
31	**People affected**	:	Nil

32	**Livestock loss**	:	Nil
33	**Communication**	:	Nil
34	**Infrastructure**	:	Nil
35	**Agriculture/ Forest/ Barren**	:	Forest
36	**Geo-scientific causes**	:	Toe erosion by stream
37	**Remedial measures**	:	Give toe support by appropriate measures to stop erosion of toe.
38	**Remarks, if any**	:	The slide is completely natural.
39	**Photo**	:	
40	**Summary/ Abstract**	:	The landslide has occurred by erosion of the toe of the slope by the stream flowing at the base. During rainfall, the water flow tends to become turbulent causing the river to erode its banks along with the weathered material, vegetation and rock fragments have also slided along the slope.
41	**Date of Reporting**	:	09.03.2020
42	**Landslide Category**	:	3

Annexure – 2-
Calculation of LOFS for all factor maps.

Geofactor: Slope Angle

Rank of Slope Angle Classes

Sl No	Class Name	Code	Rank
1	< 15°	< 15°	**4**
2	15° - 25°	15° - 25°	**6**
3	25° - 35°	25° - 35°	**8**
4	35° - 45°	35° - 45°	**5**
5	> 45°	> 45°	**4**

Matrix of Pairwise Ratings of Slope Angle Class

Slope Class	< 15°	15° - 25°	25° - 35°	35° - 45°	> 45°
< 15°	1.00	0.33	0.20	0.50	1.00
15° - 25°	3.00	1.00	0.33	2.00	3.00
25° - 35°	5.00	3.00	1.00	4.00	5.00
35° - 45°	2.00	0.50	0.25	1.00	2.00
> 45°	1.00	0.33	0.20	0.50	1.00
Sum Column	**12.00**	**5.17**	**1.98**	**8.00**	**12.00**

Slope Class	< 15°	15° - 25°	25° - 35°	35° - 45°	> 45°	Sum Rows	Frac Weight
< 15°	0.083333	0.064516	0.100840	0.0625	0.083333	0.394523	0.078904
15° - 25°	0.25	0.193548	0.168067	0.25	0.25	1.111615	0.222323
25° - 35°	0.416666	0.580645	0.504201	0.5	0.416666	2.418180	0.483636
35° - 45°	0.166666	0.096774	0.12605042	0.125	0.166666	0.681157	0.136231
> 45°	0.083333	0.064516	0.100840	0.0625	0.083333	0.394523	0.078904

Rank of Slope Curvature Classes

Sl No	Class Name	Code	Rank
1	< -0.1	Concave	**4**
2	-0.1 – 0.1	Flat	**2**
3	> 0.1	Convex	**6**

Matrix of Pairwise Ratings of Slope Curvature Class

Slope Curvature	Concave	Flat	Convex
Concave	1.00	3.00	0.33
Flat	0.33	1.00	0.20
Convex	3.00	5.00	1.00

Sum Column	**4.33**	**9.00**	**1.53**

Slope Curvature	**Concave**	**Flat**	**Convex**	**Sum Rows**	**Frac Weight**	**L**
Concave	0.230769	0.333333	0.217391	0.781494	0.260498	0
Flat	0.076923	0.111111	0.130435	0.318469	0.106156	0
Convex	0.692308	0.555556	0.652174	1.900037	0.633346	1

Geofactor: Geomorphology

Geofactor LULC
Rank of LULC Classes

CLASS	Rank	LOFS
Barren	1	0.0626
Cultivation	2	0.0937
Extensive Slope Cut	9	1.0000
Fallow Land	1	0.0626
Moderate Vegetation	5	0.2912
Plantation (HHP)	4	0.1988
Plantation (LHP)	3	0.1366
Quarry	5	0.2912
Settlement	1	0.0683
Settlement on modified slope	7	0.5631
Swamp	0	0.0000
Thick Vegetation	4	0.1988
Sparse Vegetation	7	0.5631
Water body	0	0.0000
River	0	0.0000

Table 10: Pairwise comparison matrix for LULC

LULC	**B**	**CL**	**ESC**	**FL**	**MV**	**HHP**	**LHP**	**QR**	**S**	**SM**	**TV**	**SV**
B	1.00	0.50	0.11	1.00	0.20	0.25	0.33	0.20	1.00	0.14	0.25	0.14
CL	2.00	1.00	0.13	2.00	0.25	0.33	0.50	0.25	2.00	0.17	0.33	0.17
ESC	9.00	8.00	1.00	9.00	5.00	6.00	7.00	5.00	9.00	3.00	6.00	3.00
FL	1.00	0.50	0.11	1.00	0.20	0.25	0.33	0.20	1.00	0.14	0.25	0.14
MV	5.00	4.00	0.20	5.00	1.00	2.00	3.00	1.00	5.00	0.33	2.00	0.33
HHP	4.00	3.00	0.17	4.00	0.50	1.00	2.00	0.50	4.00	0.25	1.00	0.25
LHP	3.00	2.00	0.14	3.00	0.33	0.50	1.00	0.33	3.00	0.20	0.50	0.20
QR	5.00	4.00	0.20	5.00	1.00	2.00	3.00	1.00	5.00	0.33	2.00	0.33
S	1.00	0.50	0.11	1.00	0.20	0.25	0.33	0.50	1.00	0.14	0.25	0.14
SM	7.00	6.00	0.33	7.00	3.00	4.00	5.00	3.00	7.00	1.00	4.00	1.00
TV	4.00	3.00	0.17	4.00	0.50	1.00	2.00	0.50	4.00	0.25	1.00	0.25
SV	7.00	6.00	0.33	7.00	3.00	4.00	5.00	3.00	7.00	1.00	4.00	1.00
Sum Clm	49.00	38.50	3.00	49.00	15.18	21.58	29.50	15.48	49.00	6.96	21.58	6.96

Table 11 LOFS rating for Landuse-Landcover classes

LULC	B	CL	ESC	FL	MV	HHP	LHP	QR	S	SM	TV	SV	Sum rows	Frac rate	LC FS
B	0.02041	0.012999	0.037002	0.02041	0.01551	0.01158	0.0113	0.01292	0.020241	0.02052	0.011158	0.020252	0.21283	0.01774	0.0626
CL	0.04082	0.025997	0.041665	0.04082	0.01647	0.01544	0.01695	0.01615	0.040482	0.02394	0.015444	0.023394	0.3184	0.02653	0.0937
ESC	0.18367	0.20779	0.33332	0.18367	0.32931	0.27799	0.23729	0.32293	0.183367	0.43092	0.27799	0.430392	3.39936	0.28328	1.0000
FL	0.02041	0.012999	0.037002	0.02041	0.01551	0.01158	0.0113	0.01292	0.020241	0.02052	0.011158	0.020252	0.21283	0.01774	0.0626
MV	0.10204	0.1039	0.066664	0.10204	0.06586	0.09266	0.10169	0.06459	0.102004	0.04788	0.092666	0.047888	0.98989	0.08249	0.2912
HHP	0.08163	0.07792	0.055553	0.08163	0.03293	0.04633	0.0678	0.03229	0.081663	0.03591	0.046333	0.035391	0.67586	0.05632	0.1988
LHP	0.06122	0.05195	0.04766	0.06122	0.02195	0.02317	0.0339	0.02153	0.061222	0.02873	0.023173	0.028273	0.46439	0.03887	0.1366
QR	0.10204	0.1039	0.066664	0.10204	0.06586	0.09266	0.10169	0.06459	0.102004	0.04788	0.092666	0.047888	0.98989	0.08249	0.2912
S	0.02041	0.012999	0.037002	0.02041	0.01551	0.01158	0.0113	0.03229	0.020241	0.02052	0.011158	0.020252	0.2322	0.01935	0.0683
SM	0.14286	0.15584	0.111107	0.14286	0.19759	0.18533	0.16949	0.19376	0.142864	0.14364	0.185333	0.143764	1.91425	0.15952	0.5631
TV	0.08163	0.07792	0.055553	0.08163	0.03293	0.04633	0.0678	0.03229	0.081663	0.03591	0.046333	0.035391	0.67586	0.05632	0.1988
SV	0.14286	0.15584	0.111107	0.14286	0.19759	0.18533	0.16949	0.19376	0.142864	0.14364	0.185333	0.143764	1.91425	0.15952	0.5631

Geofactor: Geomorphology

Rank of Geomorphology Classes

Sl No	Class Name	Code	Rank
1	Denudational Slope	DS	**9**
2	Escarpment	ESC	**2**
3	Mound	MOUND	**2**
4	Colluvial Foot Slope	CFS	**3**
5	Lowly Dissected Slope	LDS	**4**
6	Moderately Dissected Slope	MDS	**6**
7	Highly Dissected Slope	HDS	**8**
8	Piedmont Slope	PIED SLOPE	**4**
9	Ridge - top	RT	0
10	Tidal Flat	TF	0
11	Colluvial Plain	CP	0
12	Plateau Top (Flat)	PT	0
13	Rolling Plain	RP	0
14	Valley Fill	VF	0
15	Alluvial Plain	AP	0
16	Beach	BE	0
17	Pediment – Pediplain Complex	PPC	0
18	Hilltop	HT	0
19	Water body	WB	0

Matrix of Pairwise Ratings of Geomorphology Class

GEOM	DS	ESC	MOUND	CFS	LDS	MDS	HDS	PIED SLOPE
DS	1.00	8.00	8.00	7.00	6.00	4.00	2.00	6.00
ESC	0.13	1.00	1.00	0.50	0.33	0.20	0.14	0.33
MOUND	0.13	1.00	1.00	0.50	0.33	0.20	0.14	0.33
CFS	0.14	2.00	2.00	1.00	0.50	0.25	0.17	0.50
LDS	0.17	3.00	3.00	2.00	1.00	0.33	0.20	1.00
MDS	0.25	5.00	5.00	4.00	3.00	1.00	0.33	3.00
HDS	0.50	7.00	7.00	6.00	5.00	3.00	1.00	5.00
PIED SLOPE	0.17	3.00	3.00	2.00	1.00	0.33	0.20	1.00
Sum Column	**2.48**	**30.00**	**30.00**	**23.00**	**17.17**	**9.32**	**4.19**	**17.17**

LOFS rating for Geomorphology Class

GEOM	DS	ESC	MOUND	CFS	LDS	MDS	HDS	PIED SLOPE	Sum Rows	Frac Weight
DS	0.4038	0.2667	0.2667	0.3043	0.3495	0.4293	0.4778	0.3495	2.8477	0.3560
ESC	0.0505	0.0333	0.0333	0.0217	0.0194	0.0215	0.0341	0.0194	0.2333	0.0292

MOUND	0.0505	0.0333	0.0333	0.0217	0.0194	0.0215	0.0341	0.0194	0.2333	0.0292
CFS	0.0577	0.0667	0.0667	0.0435	0.0291	0.0268	0.0398	0.0291	0.3594	0.0449
LDS	0.0673	0.1000	0.1000	0.0870	0.0583	0.0358	0.0478	0.0583	0.5543	0.0693
MDS	0.1010	0.1667	0.1667	0.1739	0.1748	0.1073	0.0796	0.1748	1.1447	0.1431
HDS	0.2019	0.2333	0.2333	0.2609	0.2913	0.3220	0.2389	0.2913	2.0729	0.2591
PIED SLOPE	0.0673	0.1000	0.1000	0.0870	0.0583	0.0358	0.0478	0.0583	0.5543	0.0693

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Slope Forming Material Maps

Geofactor: Slope Forming Material (SFM)

Rank of SFM Classes Sl No	Class Name	Code	Rank
1	Compact Slide Debris	CSD	**3**
2	In – situ Soil	IS	**4**
3	Colluvium	CL	**5**
4	Loose Slide Debris	LSD	**8**
5	Rock Class Type – I	R - I	**1**
6	Rock Class Type – II	R - II	**2**
7	Rock Class Type – III	R - III	**4**
8	Transported Soil	TS	**3**
9	Weathered Rock	WR	**6**
10	Salt	SL	0
11	Water	WT	0
12	Alluvium	AL	0
13	Barren Sand	BS	0

Geofactor: Slope Forming Material (SFM)

Matrix of Pairwise Ratings of SFM Class

SFM	CSD	IS	CL	LSD	R – I	R – II	R – III	TS
CSD	1.00	0.50	0.33	0.17	3.00	2.00	0.50	1.00
IS	2.00	1.00	0.50	0.20	4.00	3.00	1.00	2.00
CL	3.00	2.00	1.00	0.25	5.00	4.00	2.00	3.00
LSD	6.00	5.00	4.00	1.00	8.00	7.00	5.00	6.00
R - I	0.33	0.25	0.20	0.13	1.00	0.50	0.25	0.33
R - II	0.50	0.33	0.25	0.14	2.00	1.00	0.33	0.50
R - III	2.00	1.00	0.50	0.20	4.00	3.00	1.00	2.00
TS	1.00	0.50	0.33	0.17	3.00	2.00	0.50	1.00
WR	4.00	3.00	2.00	0.33	6.00	5.00	3.00	4.00
Sum Column	**19.83**	**13.58**	**9.12**	**2.58**	**36.00**	**27.50**	**13.58**	**19.83**

SFM	CSD	IS	CL	LSD	R – I	R – II	R – III	TS	WR	Sum Rows
CSD	0.0504	0.0368	0.0366	0.0645	0.0833	0.0727	0.0368	0.0504	0.0414	0.4730
IS	0.1008	0.0736	0.0548	0.0774	0.1111	0.1091	0.0736	0.1008	0.0552	0.7566
CL	0.1513	0.1472	0.1097	0.0967	0.1389	0.1455	0.1472	0.1513	0.0829	1.1706
LSD	0.3025	0.3681	0.4388	0.3869	0.2222	0.2545	0.3681	0.3025	0.4972	3.1409
R - I	0.0168	0.0184	0.0219	0.0484	0.0278	0.0182	0.0184	0.0168	0.0276	0.2143
R - II	0.0252	0.0245	0.0274	0.0553	0.0556	0.0364	0.0245	0.0252	0.0331	0.3073
R - III	0.1008	0.0736	0.0548	0.0774	0.1111	0.1091	0.0736	0.1008	0.0552	0.7566
TS	0.0504	0.0368	0.0366	0.0645	0.0833	0.0727	0.0368	0.0504	0.0414	0.4730

WR	0.2017	0.2209	0.2194	0.1290	0.1667	0.1818	0.2209	0.2017	0.1657	1.7077



Geofactor: Regolith Thickness

Rank of Regolith Thickness Classes

Sl No	Class Name	Code	Rank
1	< 0.5 m	< 0.5 m	0
2	0.5 m – 5 m	0.5 m – 5 m	**7**
3	5 m – 10 m	5 m – 10 m	**4**
4	> 10 m	> 10 m	**2**

Matrix of Pairwise Ratings of Regolith Thickness Class

Regolith Thickness	0.5 – 5 m	5 – 10 m	> 10 m
0.5 – 5 m	1.00	4.00	6.00
5 – 10 m	0.25	1.00	3.00
> 10 m	0.17	0.33	1.00
Sum Column	**1.42**	**5.33**	**10.00**

Regolith Thickness	0.5 – 5 m	5 – 10 m	> 10 m	Sum Rows	Frac Weight	
0.5 – 5 m	0.705882	0.75	0.6	2.055882	0.685294	1
5 – 10 m	0.176471	0.1875	0.3	0.663971	0.221324	0
> 10 m	0.117647	0.0625	0.1	0.280147	0.093382	0

Table showing mutual comparison of individual factor maps and weights.

Factor Classes	Rank
Slope	9
Curvature	2
SFM	6
LULC	8
Geomorphology	6
Regolith Thickness	4

Factor	Slope	Curvature	SFM	LULC	Geom	RT
Slope	1.00	8.00	4.00	2.00	4.00	6.00
Curvature	0.13	1.00	0.20	0.14	0.20	0.33
SFM	0.25	5.00	1.00	0.33	1.00	3.00
LULC	0.50	7.00	3.00	1.00	3.00	5.00
Geom	0.25	5.00	1.00	0.33	1.00	3.00
RT	0.17	3.00	0.33	0.20	0.33	1.00
Sum Clmn	2.29	29.00	9.53	4.01	9.53	18.33

Factor	Slope	Curvature	SFM	LULC	Geom	RT	Sum rows	Frac rate	Weight	Weight W N
Slope	**0.43636**	**0.27586**	**0.41958**	**0.49881**	**0.41958**	**0.32727**	**2.37747**	**0.39625**	**12.8653**	**13**
Curvature	**0.05455**	**0.03448**	**0.02098**	**0.03563**	**0.02098**	**0.01818**	**0.18480**	**0.0308**	**1**	**1**
SFM	**0.10909**	**0.17241**	**0.10490**	**0.08314**	**0.10490**	**0.16364**	**0.73807**	**0.12301**	**3.99392**	**4**
LULC	**0.21818**	**0.24138**	**0.31469**	**0.24941**	**0.31469**	**0.27273**	**1.61107**	**0.26851**	**8.718**	**9**
Geom	**0.10909**	**0.17241**	**0.10490**	**0.08314**	**0.10490**	**0.16364**	**0.73807**	**0.12301**	**3.99392**	**4**
RT	**0.07273**	**0.10345**	**0.03497**	**0.04988**	**0.03497**	**0.05455**	**0.35053**	**0.05842**	**1.89685**	**2**

Annexure 3
Rainfall data in mm (10 years) for Uttara Kannada District

Taluk / Year	2010	2011	2012	2013	2014	2015	2016	2017	2018
Ankola	2869.3	3868.05	3734	3689.5	3553.5	2603.9	2931.7	3112	3669
Bhatkal	4758.8	4317.2	3586.5	4551.8	3978.1	3296.1	3196.4	3623	3318
Honnavar	4229	4447.7	3698.5	3939.5	3434	3045.3	3350.0	3601	3793
Karwar	4219.9	3506.4	3346.5	2794.5	3344.5	2842.3	2907.7	3046	3618
Kumta	3703.5	3870.05	3870.05	3947	3497.5	2820.6	3012.2	3248	3209
Mundgod	1969.3	1163.3	818.8	1153.2	1094.9	1074.3	832.3	1018	1301
Siddapur	3429.2	4361.6	3680.5	3255.6	4000	2545.0	2539.3	2854	4129
Sirsi	2431.1	2942.7	2095.6	2641	2378.9	1960.7	1950.1	2299	2968
Haliyal	1285.4	1368.4	950.6	1245	1249	814.6	752.2	955	1238
Supa	2488.7	2732.41	1749.7	2573.4	2450.2	1990.3	2279.8	2582	3233
Yellapur	2104.2	2700.29	1903.7	2720.2	2779.5	1548.6	1495.3	1670	2184
Total	**33488.4**	**35278.1**	**29434.45**	**32510.7**	**31760.1**	**24541.7**	**25219.9**	**28008**	**32659**

Check List for Peer Reviewer

	Topics	Comments of Peer Reviewer
1.	Whether the aims and objectives of the item has been achieved	
2.	Density of data collection required for achieving the target	
3.	Analysis and interpretation of the basic data	
4.	Collection of samples as per NQT	
5.	Analytical data incorporated, analyzed and proper interpretation	
6.	Requisite lab studies, petrology, petrography and its interpretation	
7.	Has the report brought out the required outcome keeping in view the aims, objective and in light of the back ground information provided in the item/NQT	
8.	Has the investigation been brought to a logical conclusion and recommended properly for follow up	
9.	Grade (in a scale 1-10), Specially from the quality, content and usefulness for end user	
10.	General comments on Report and scope for follow up/ improvement	

Date:

Signature :
Name :
Designation :