सत्यमेव जयते
Goverment Of India

NATIONAL LANDSLIDE RISK MITIGATION PROGRAMME

(NLRMP)

PHASE-1

National Disaster Management Authority (NDMA)
Government of India

Contents

EXECUTIVE SUMMARY

National Programme on Landslide Risk Reduction & Mitigation

1. Background

The mountain regions in the country, particularly the Himalayas and the Western Ghats, are high-risk areas for many Indigenous and economically disadvantaged rural people. The mountain region of India is susceptible to various types of landslides, especially the mountain slopes of the North-Western Himalayas and the Sub-Himalayan terrain of the North-East and Western-Eastern Ghats. About 0.42 million $km^{2,}$ covering nearly 12.6% of the land area of our country, is prone to landslide hazards, posing a threat to life and livelihood (GSI, 2022). Landslides are becoming more severe in a cascading progression in magnitude and frequency. This has caused widespread devastation in terms of loss of life and property, particularly in the fragile mountain environment of the Himalayan and Western Ghats. Its repercussions undermine the mountainous region's development aspirations and severely setback the nation's economy. No Ministry/ Department of the Government of India has any comprehensive national programme on landslide risk reduction and mitigation for the landslide-affected regions of India. To fill this gap, NDMA has proposed a national-level programme with a holistic approach to mainstream Landslides Risk Reduction and Mitigation for implementation through identifying drivers/ project proponents at the national level, state level and other stakeholders. Participation of the local community is essential for the overall project success as it enhances ownership of outcomes and infrastructure generated under the programme.

2. Thrust Area

The National Programme on Landslide Risk Reduction and Mitigation focuses on developing and implementing mitigation strategies for reducing the risk of landslides. It covers institutional mechanisms, disaster prevention strategy, early warning systems, disaster mitigation, preparedness, and human resource development for landslide risk mitigation and management. The following are the thrust areas of the National Programme on landslides:

- Prioritizing and strengthening early warning, preparedness, prevention and mitigation by leveraging Science and Technology (S&T)
- Integrating space technology into identification, monitoring, and mitigationmechanisms
- Holistic landslide risk assessment and mitigation
- Effective implementation of land-use management regulations and policies on the ground
- Developing mitigation measures for landslide risk reduction and mitigation in a phased manner
- Bringing together all stakeholders onboard for the management of landslides
- Use of Indigenous knowledge alongside scientific knowledge for reducing landslide risk and other related hazards
- Developing landslide monitoring solutions
- Developing mechanical capacities at the state level to strengthen line departments

3. Objectives

The National Programme on Landslide Risk Reduction and Mitigation seeks to provide a mechanism to enhance landslide resilience through local-level interventions to address landslide risk and vulnerability effectively. To achieve this goal, the primary objectives of the programme are:

- Preventing the loss of life due to landslide events
- Reduce economic loss due to the landslide impacts
- Strengthen the early warning system (EWS) based on last-mile connectivity
- Strengthening scientific and technical capabilities in landslide risk reduction and mitigation atvarious levels
- Empower local communities as partners to reduce and mitigate landslide risk

4. Approach

The programme adopts a comprehensive approach to facilitate the implementation of priority actions in the Sendai Framework for Disaster Risk Reduction (2015-2030). Even though this is a national programme, it is the responsibility of each state to plan and execute the programme successfully at the regional and ground level. In this context, enhancing the technical capability of SDMAs and DDMAs in landslide risk governance is vital at the state and district levels. Since this is a community-centric programme, the local community's involvement in all its stages, from the identification of planning strategies to successful implementation, is crucial. Hence, planning and execution of the programme at SDMAs and DDMAs and the involvement of the local community can facilitate landslide risk concerns in the developmental planning and processes of the mountain environment. This programme may also be integrated with the ongoing skill initiatives of the Government of India like the Mahatma Gandhi National Rural Employment Guarantee Scheme (MGNREGS), National Rural Livelihood Mission (NRLM), and National Urban Livelihood Mission (NULM) to reduce landslide risk and its mitigation.

5. Coverage of States

The national programme will be implemented in phases as landslides are site-specific, and their vulnerability varies according to the geographical, geological and geodynamic conditions. Phase I comprises **15 states**. The States included in this phase are Himachal Pradesh, Uttarakhand, Sikkim, West Bengal, Assam, Manipur, Tripura, Arunachal Pradesh, Nagaland, Mizoram, Meghalaya, Maharashtra, Karnataka, Kerala and Tamil Nadu. These States have been selected based on areas vulnerable to landslides (as available from ' National Landslide Susceptibility Mapping (NLSM)' data of GSI, Annexure-A) and its exposure. The districts have been indicated here on the same grounds for each state. However, the States may prioritize districts based on their assessment of risks in consultation with NDMA.

NDMA will submit another proposal for the subsequent phases covering the remaining states affected by landslides and other mountain hazards. Details of the selected states and the districts are given in the following table:

Table I: Project Implementing states and districts for phase 1

Northern Himalaya		Northern Eastern Himalaya		Western Ghats	
States/UTs	District	States/UTs	District	States/UTs	District
Himachal Pradesh	Chamba	Arunachal Pradesh	Upper Subansiri	Maharashtra	Pune
	Mandi		Anjaw		Ratnagiri
	Kinnaur		Papum Pare		Thane
	Shimla		West Siang		Raigarh
Uttarakhand	Uttarkashi	Sikkim	North District	Tamil Nadu	Nilgiris
	Chamoli		West District		Coimbatore
	Pithoragarh	Nagaland	Mokokchung	Kerala	Wayanad
	Almora		Phek		Idukki
			Kohima		Pathanamthitta
			Peren	Karnataka	Kodagu
West Bengal	Darjeeling	Mizoram	Aizawl		Chigmangloor
	Kalimpong		Champhai		
			Serchhip		
			Saiha		
		Meghalaya	East Khasi hill		
			West Khasi hill		
		Manipur	Ukhrul district		
			Tamenglong district		
		Assam	Cachar		
			Dima Hasao		
		Tripura	Dhalai		
			North Tripura (Old)		

6. Major Components

The programme has four major components and activities for making India's landslide disaster resilient. Details of each component are given as follows:

Component I: Landslide Risk and Vulnerability Assessment- Landslide risk assessment can be done by evaluating the probability of physical and human loss and other elements at risk in landslide-susceptible areas. In addition, evaluating social and physical vulnerability on a regional scale is essential for assessing landslide risk. Four significant activities have been incorporated under the risk vulnerability assessment. Creating a Landslide Inventory Database, which aims to develop a catalogue and categorize the past landslide details, is the first of four primary activities outlined. The second initiative is formulating a GIS-based Slope Information System, a web-based platform that collects data on all natural and man-made landslide slopes. The third activity is Geo-technical Investigation and mapping, which assesses the resilience of infrastructural developments in high landslide-risk areas. Finally, to develop meso-

scale (1:10000, 1:5000) maps for all the vulnerable villages or taluks of major landslide-prone regions in the country.

Component II: Landslide Monitoring and Early Warning System - Landslide monitoring and early warning have effectively reduced disaster risk and loss of life. A landslide early-warning system (LEWS) can model landslide occurrences and promptly warn about impending danger.There are promising initiatives for developing technology in landslide monitoring and early warning, including sensor-based technologies/instrumentation for monitoring landslides on a pilot basis for different parts of the country. This needs further upgraded to continuously disseminate alerts and warnings available to the local platform by integrating various government departments. Activities under this are the use of the latest science and technology tools to develop monitoring and early warning systems with last-mile connectivity.

Component III: Slope Stabilization - Most vulnerable states must develop mitigation strategies feasible to local conditions for immediate requirements. Under this component, four significant activities have been included- **1)** Community-based slope stabilization by local intervention for drainage management and correction in the unstable slope, **2)**Bio restoration vegetative method for stabilizing slopes using indigenous plant species, an Eco- DRR initiative **3)**Strengthen landslide risk aspects in the states, building regulations and rules to improve theresilience of the built environment**.** It emphasizes land use regulation for mountain areas. **4)**Identifying and adopting site-specific structural measures for landslide mitigation is the most significant activity that comes under this component. The implementation of this activity should be based on the feasibility of the site-specific implementation, including social and environmental acceptability.

Component IV: Awareness Generation and Capacity Building - Awareness generation and capacity building are crucial for addressing and reducing landslide risk and accelerating initiatives in the various phases of disaster management, such as preparedness, mitigation, response, and rehabilitation. Awareness and capacity-building programmes will be successful with the involvement of local communities and authorities such as district administration, panchayat raj institutions (PRI) and local communities. Capacity building programmes for state and district officials, PRI / village council members, and sensitization programmes for local communities are the major activities proposed under this component. Creation of Mountain Hazard Cell (MHC) at NDMA and identification of technical institute at the state/national level for landslide risk reduction is also unique activity under this programme.

7. Budget Outlay

The total budget of the Programme (NLRMP) in the first phase is ₹1000 crores for up to 31st March 2026 (Table II). The programme will be funded by NDMF for States. States' share will be applicable as per extant NDMF guidelines. Details of allocation for components of the programme in terms of percentage of total programme outlay are given in the following table:

Table II: Total budget for National Programme

Component	Activities	Sub-component Ratio in %	Component Ratio in %	Sub-Component Amount (Rs. Cr)	Component Amount (Rs. Cr)
1. Landslide Risk and Vulnerability Assessment	1. Creation of Landslide Inventory database	15	**16%**	24	160
	2. Developing a GIS-based slope information system	15		24	
	3. Developing meso-scale maps for high-risk areas	55		88	
	4. Geo-technical Investigation and Mapping of vulnerable existing infrastructure	15		24	
2. Landslide Monitoring and Early Warning System	1. Sensor Based Local Early Warning System (EWS)	75	**22%**	165	220
	2. Landslide Monitoring and Development, Integration & Dissemination (DID) of hazard information	25		55	
3. Slope Stabilization	1. Community-based slope stabilization by local interventions	20	**55%**	110	550
	2. Bio restoration /Bio-Engineering Measures	30		165	
	3. Site-specific structural measures	46		253	
	4. Enacting and enforcement of building rules and regulations	4		22	
4. Awareness Generation and Capacity Building	1. Sensitization Programmes for communities and the Panchayat Raj Institution members including creation of a village task force in landslide-prone areas	20	**7%**	14	70
	2. Sensitization Programmes for state and district level officers in landslide-prone areas.	8		5.6	
	Research and Development (Small grant window)	72		50.4	
			100%	1000	1000

Allocation of fund among components/sub-components have been mentioned in terms of percentage of gross allocation. State-wise distribution of funds with specific allocation for different components

are indicated in Annexure-C. States will divide allocated funds among components and sub-components as per the ratio shown in Table II. There could be flexibility for the reallocation of funds across sub-components of a component by States as per respective requirements; however, the fund allocation across components may be inter-changeable only with the approval of NDMA. States should spend at least 50 % of allocated funds for component- III (Slope Stabilization) of the programme.

The state-wise details of allocations for the utilization of funds up to 31st March 2026 (Phase 1) are given in Table III:

Table III: State-wise Budget Allocation

Sl. No	States	Centre share (Rs in crore)	States' share (Rs in crore)	Total Budget
	Earmarked States @			
1	Uttarakhand	125 #	14	139
2	Himachal Pradesh	125 #	14	139
3	Mizoram	45*	5	50
4	Nagaland	45	5	50
5	Manipur	45	5	50
6	Arunachal Pradesh	45	5	50
7	Sikkim	45	5	50
8	Meghalaya	45	5	50
9	Assam	60	7	67
10	Tripura	10	1	11
	Non –Earmarked States $			
11	Maharashtra	90	10	100
12	Karnataka	65	7	72
13	Kerala	65	7	72
14	Tamil Nadu	45	5	50
15	West Bengal	45	5	50
	Total	**900**	**100**	**1000**

[#For the State of Uttarakhand and Himachal Pradesh, 125 crore will be given from earmarked allocation only.
*For eight North-eastern States (sl. no 3 to 10), out of the total central allocation of Rs 340 crore, Rs. 125 crore will be given from earmarked allocation, and the rest, Rs 215 cr will be given from non-earmarked funds.
@ Total earmarked allocation for this program is Rs 375 crore.
$ The remaining amount of Rs. 525 Crore is non-earmarked fund, which will be allocated from regular NDMF.
Annexure D - Allocation of XVFC earmarked fund of Rs. 750 cr across seismic and landslide hazard has been shown at Annexure D.]

8. Project appraisal, approval, and Monitoring

The technical, financial, and social aspects of the DPRs of the mitigation project will be appraised and reviewed by the Technical Advisory Committee (TAC) and Project Appraisal Committee (PAC), which are constituted at the NDMA and SDMA levels. TAC will be established to appraise projects from the technical and social point of view, conduct a technical review of projects sanctioned from mitigation funds, and recommend improvement. After the TAC has completed its technical evaluation, the Project Appraisal Committee (PAC) will appraise the project from an administrative and financial standpoint. NDMA will provide technical assistance to any project approved under NDMF/SDMF and publish the findings on the mitigation portal.

NATIONAL LANDSLIDE RISK MITIGATION PROGRAMME

9. Background

The mountain regions in the country, particularly the Himalayas and the Western Ghats, are high-risk areas for many indigenous and economically disadvantaged rural people. In recent decades, many areas have witnessed rapid urbanization and an increased population density, putting pressure on the land due to the rise in housing and infrastructure facilities. Unscientific building construction, mining, quarries, and infrastructural development activities such as the construction of roads, dams and reservoirs, telecommunications network systems, and tourism-related activities exceed the natural carrying capacity of the fragile mountain regions. These unsustainable developmental activities lead to widespread environmental degradation, resulting in increased natural hazards such as landslides, avalanches, Glacial Lake Outburst Floods (GLOF), Building collapse, flash floods, and cloudbursts. Unfortunately, policymakers and urban planners have paid little attention to mountain planning and development.

The mountain region of India is susceptible to various types of landslides, especially the mountain slopes of the North-Western Himalayas and the Sub-Himalayan terrain of the North-East and the Western-Eastern Ghats.) About 0.42 million $km^{2,}$ covering nearly 12.6% of the land area of our country is prone to landslide hazards posing a threat to life and livelihood (GSI,2022). The disruptions range from everyday activities to widespread loss of life and property and destruction in large parts of the mountainous region of India.

The northern Himalayan states of India, especially Himachal Pradesh, Uttarakhand and the country's North-Eastern states viz. Sikkim, Arunachal Pradesh, Mizoram, Nagaland, Manipur, Meghalaya, Assam, and Tripura are vulnerable to landslides due to active Seismo-tectonics, rugged topography, lithology, geology, prolonged rainfall, and anthropogenic activities. The Western Ghats region, covering parts of Maharashtra, Karnataka, Goa, and Kerala, is vulnerable to landslides due to soil weathering, intense rainfall, steep slopes, soil piping, and anthropogenic activities.

The Himalayan mountain range is vulnerable to landslides and mass movements related to processes caused due to monsoon rainfall and frequent seismo-tectonic activities. The mountain range consists

of tectonically unstable younger geological formations that have seen significant seismic activities. This terrain falls in the maximum earthquake-prone zones (Zone-IV and V) (Bureau of Indian Standard, 2002)and is prone to earthquake-triggered landslides(GSI, 2022). Here the landslides are massive and many as compared to the Western Ghats region, which is geologically stable but has uplifted plateau margins influenced by neo-tectonic activities. The Western Ghats are the most landslide-prone region after the Himalayas and northeast in the country due to its steep slope, high rainfall intensity and thick soil cover. The eastern sides of the Western Ghats receive intense rainfall during the southwest monsoon, leading to frequent landslides. Along with this, the high population density and its resulting activities like deforestation, slope modification, quarrying, and unsustainable land-use practices in ecologically sensitive areas have increased the rate of landslide occurrences.

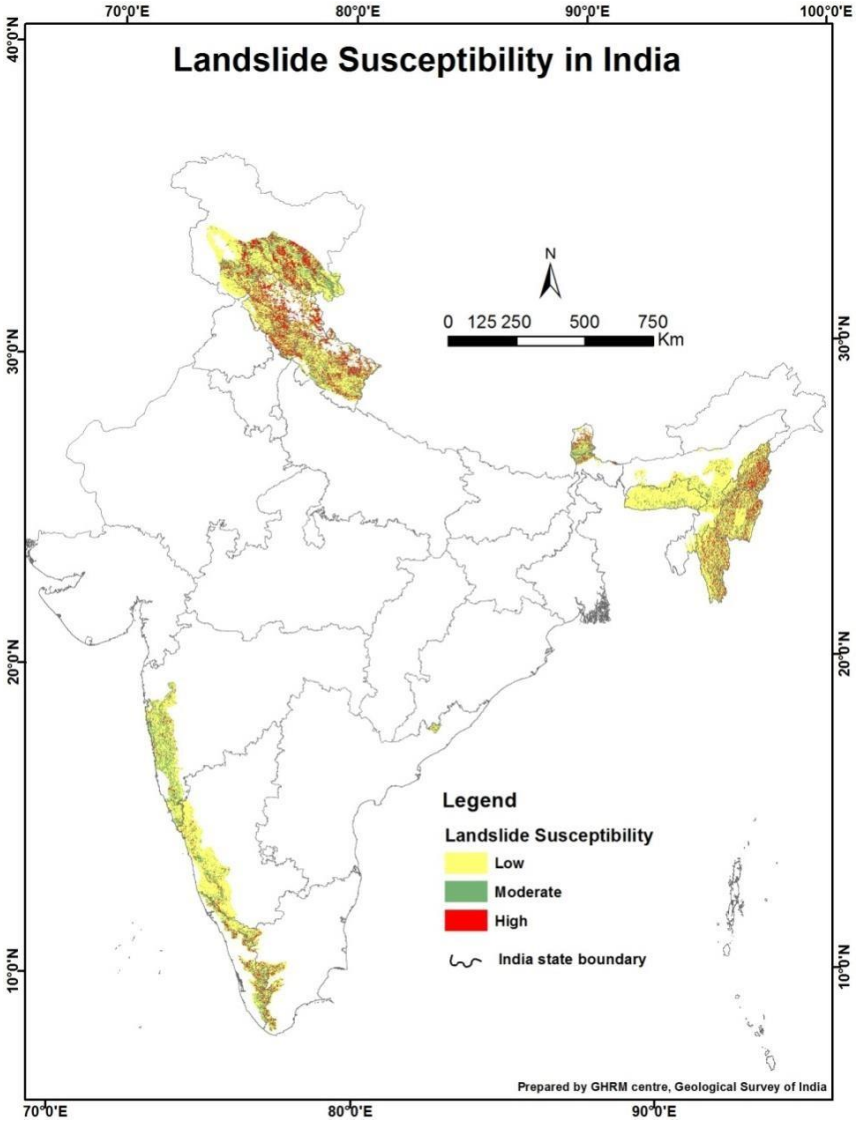


Figure 1: Landslides Susceptibility Map of India
(**Source:** GSI)

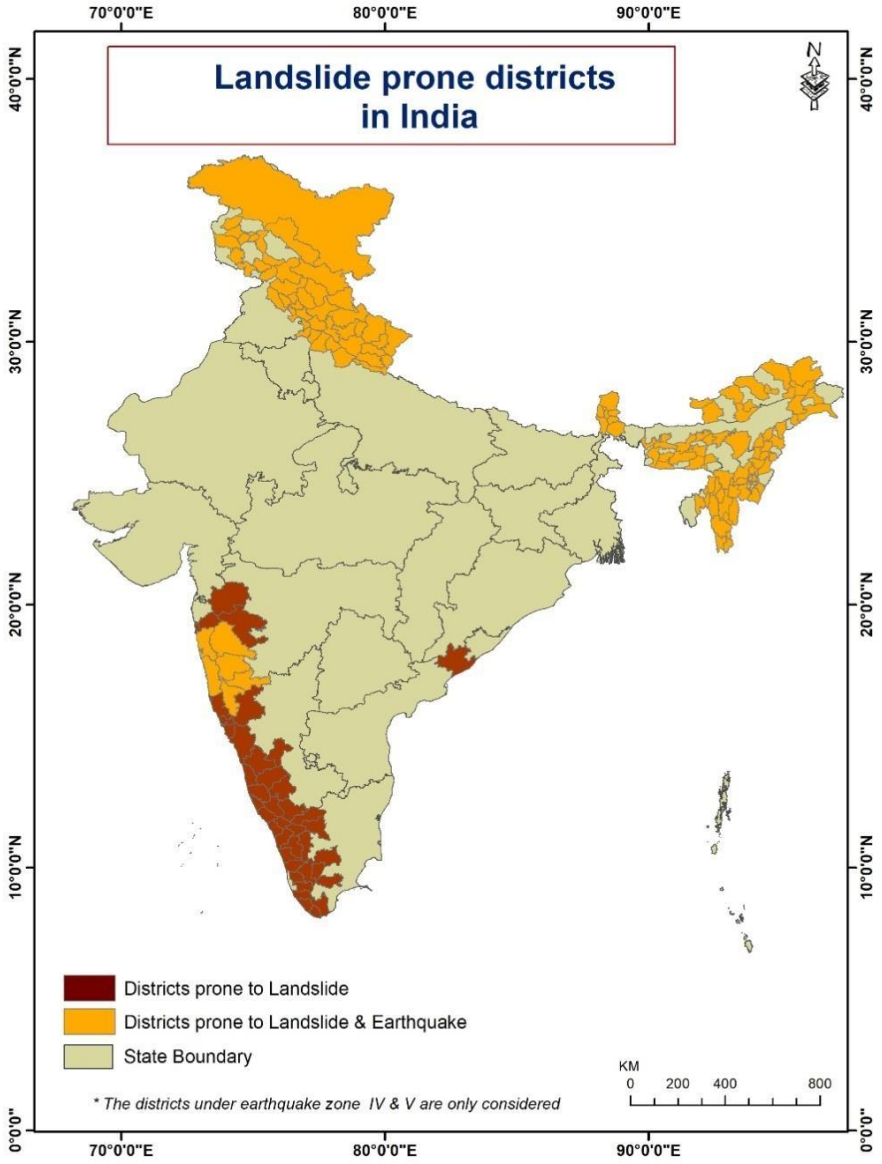


Figure 2: Landslides Prone Districts in India

A detailed list of district wise landslide susceptibility conditions in the hilly areas in India is enclosed in **Annexure-'A'**. This list was taken from GSI's National Landslide Susceptibility Mapping (NLSM) programme.

10. Causes of Landslide Occurrence in India

Landslides in the country are caused due to geological and hydro-meteorological factors. Most landslides are triggered by heavy rainfall during the monsoon season. Rainfall-induced landslides are common natural hazards across the hilly regions in the country. Due to climate change and extreme weather events, massive and unpredicted rainfall-induced landslides are becoming more common, particularly in the Western Himalayas,Eastern Himalayas, and Western Ghats region.

The Himalayan regions are vulnerable to high precipitation, which has increased by climate change. These regions experience frequent occurrence of landslide phenomenon usually triggered byextreme climate events like high-intensity, short-duration rainfall, cloudburst, GLOF, etc.

(Dutta,2021).Usually, the Himalayan region exhibits shallow landslides triggered by high-intensity rainfall within a short duration, while most deep-seated landslides are related to the rainfall duration lasting for an extended period (Chen,2017). In the recent past, short-duration, high-intensity rainfall like cloudburst event has become common in many areas of the Himalayas. Cloudbursts accompanied by flash floods during heavy rainfall are the leading cause of landslides in the Himalayan region. Cloudbursts may also cause flash floods and breaches of the glacial lake moraine dam, which causes the occurrence of GLOF events. The prolonged rainfall causes water to seep into the rocks, fractures and surfaces allowing water to percolate. This increases the pressure on the slopes and these features combined with surface runoffs cause landslides in the regions.

During the monsoon period, landslides are regularly in the Western Ghats, and their intensity depends upon the thickness of the loose, unconsolidated regolith material (Thampi et al., 1998). The Western Ghats region experiences shallow landslides and debris flow more common than deep-seated ones. The processes leading to landslides were accelerated by anthropogenic disturbances such as deforestation since the early 18th century, terracing and obstruction of ephemeral streams and cultivation of crops lacking capability to add root cohesion in steep slopes. The events have become more destructive given the increasing vulnerability of population and property (Kuriakose et al., 2009). Weathering rates are seen to have an influence in the volume of material accumulated (Sajin Kumar et al., 2011). Soil piping phenomenon is a major intrinsic contributor to landslide initiation in the region (Sankar et al, 2016). Studies conducted in the states indicate that prolonged and intense rainfall or more particularly a combination of the two and the resultant persistence and variations of pore pressure is the most important trigger of landslides. It is known that continuous and high intensity rainfall of about fourhrs. may cause a steep rise in the perched water table up to critical levels in regolith filled bedrock depressions and the persistence of this level for ~10 hrs. may lead to shallow landslides in the catchment (Kuriakose et al., 2008). It is observed through studies that as the number of days prior to landslide increases, the distribution of landslide events shifts towards antecedent rainfall conditions (Abraham et al., 2019).

The recent devastating landslides occurred inChamoli and Nainital district-Uttarakhand (2021), Batseri-Sangla, Kinnaurdistrict-Himachal Pradesh (2021),Mamkhola near Melli Bazaar, South district-Sikkim (2021),Taliye village in Raigad district-Maharashtra (2021),Kootickal in Kottayam district-Kerala (2021),Patan in Satara district-Maharashtra (2021),Kavalappara in Malappuram district-Kerala (2019), Pettimudi in Idukki district-Kerala (2020), TNEB Colony, Nilgiri district-Tamil Nadu (2020), Bhagamandala, Kodagu district-Karnataka (2020).

Disasters occurring in the Indian mountain regions are extreme weather events in which cascading effects increase over time and generate unexpected secondary events of strong impact. Flash floods may occur after landslide dam breaches, high-intensity, short-duration rainfall or landslides. GLOF can also cause flash floods downstream which may be triggered by moraine dam breaches, rockfall and snow avalanches in the glacier region.

Earthquake-induced landslides have been recognized as a potential hazard in mountainous regions as they amplify the structural damage and economic losses due to their seismicity. The majority of landslide-prone areas in the Himalayan region are located in the earthquake-prone seismic Zone IV and V (GSI,2022). Thus, these areas are also prone to earthquake-triggered landslides e.g. Sikkim Earthquake

(2011), Kashmir Earthquake (2005), Chamoli Earthquake (1999), Uttarkashi Earthquake (1991) etc. Global warming and seismo-tectonic activity in the glacier region may also breach the glacial lake's moraine dam, which may consequently lead to the occurrence of GLOF. The domino effects of these geological, climate change/ extreme weather disastrous events pose a serious threat to life, property, livelihood, geo-environmental balance, loss of habitat, etc.

Table 1: Mountain Hazards Susceptible Regions in the Country (Source: GSI Landslide Susceptibility data)

Mountain Hazard		Landslide			Snow Avalanche	Earthquake	Forest Fire	GLOF
		Debris flow/ Mudflow	Rockfall	Soil Piping				
Region	**North-Western Himalayas**	**(High)** Himachal Pradesh & Uttarakhand	**High**	-	**(High)** Himachal Pradesh, Uttarakhand, Sikkim, Ladakh& Jammu Kashmir	**(Very High - High)** Ladakh under zone - V, other Northwestern Himalayan regions under zone –IV&V, North-eastern Himalayan regions under zone - V	**Very High**	**(Very High)** Mountainous regions of Himachal Pradesh,& Uttarakhand
	North-East Himalayas	**(Medium)** All thenorth-eastern states during the Southwest monsoon period.	**Low**	**Low**	**(Medium)** Sikkim, Arunachal Pradesh	Under Zone V	**High**	**(Very High)** Sikkim & Arunachal Pradesh
	Western Ghats	**(Moderate)** Windward side of the Western Ghats during southwest monsoon covering the states of Kerala, Karnataka, Maharashtra,	**Low**	**(High)** Plantation areas in Kerala & Karnataka	-	**(High - Medium)** Maharashtra under zone- IV & V; Kerala & Karnataka under Zone III.	**Moderate**	-

The growing population on fragile land has primarily increased the impact of natural disasters in the mountainous region of India. Many landslides reported in the Himalayas and Western Ghats region are caused as a result of the environmental deterioration caused by human encroachment, deforestation and unsustainable development activities.

In recent decades, the Himalayan region has experienced forest fragmentation and deforestation. Several anthropogenic influences like increased urbanization, mono-cropping, overgrazing, faulty road construction, and unsustainable building construction practices have led to slope instability, which may increase the likelihood of landslides. Moreover, due to high-intensity rains, natural drainage on slopes is obstructed or altered without enough provision of surface water runoff resulting in slope failure and landslide activities. All these anthropogenic activities have exacerbated the process of slope collapse, damage to road networks, connectivity, and loss of life-livelihood during landslides.

The Western Ghats is the highest human population per unit area in the mountain region in the country (Molur et al.,2011). The region has almost lost nearly 50% of the forest cover since early 1900s and the trend is continuing with increased fragmentation and encroachment. As a result of high population density, human activities like land-use changes, unscientific developmental activities, quarrying on a massive scale, broad mono-cropping agricultural practices and pressure of tourism activities have increased the landslide events. Most Western Ghats regions come under high rainfall zones with a wide natural drainage network. Due to anthropogenic influences, blockage of natural drainage or modification of slopes without adequate surface drainage of excess storm- water increases the likelihood of landslides across the region.

11. Recent Occurrences of Landslides and their Impacts

Landslide causes loss of life, property, habitat and damage to the economy and infrastructure (roads, bridges, railway line etc.) with an impact on ecology and ecosystem. Due to extreme rainfall events during the last southwest monsoon season, many parts of Himachal Pradesh, Uttarakhand, Maharashtra, Sikkim and Kerala were affected by the landslides with loss of life and property. The summary of losses and damage in the aforesaid states is given in Table 2 below:

Table 2: Recent Landslides in the Country (Source: MHA Situation Report 2021)

Sl. No.	States	District	Name of the affected site	Losses& Damage
1	Himachal Pradesh	Kinnaur	• Shooting stone/ rock fall at Batseri-Sangla, andKinnaur • NH-5 in tehsil Nichar at NigulSari in district Kinnaur	▪ 9 dead and 3 injured and a loss of Rs. 2.50 crores as reported by DDMA, Kinnaur ▪ 19 dead, 10 missing and 13 injured
		Sirmaur	NH-707 at Sirmaur district	Road connectivity disturb between Paonta Sahib and Shillai-Hatkoti due to the 100 m stretch of NH 707 collapsedat Kali Dhank (Barwas) in the Sirmaur district.
		Lahaul-Spiti	Blockage of Chandrabhaga tributary of River Chenab at Nalda village in Lahaul-Spiti	More than 200 people were stranded in Lahaul-Spiti and rescued.
2	Uttarakhand	Chamoli	Mannkadi block, Joshimath, Chamoli	3 dead, 4 injured and 15 houseswere damaged. Rishikesh-Badrinath NH-58 was blocked near Keemkholi, Randaag, Kanchanganga and Laamgarh.
		Pauri	Chamkhal Lansdowne, Pauri	3 dead and 2 injured. Roads were blocked which included NH at Srinagar-Chamdhar and Kotdwar-Pauri.
		Nainital	Kainchidham, Kwarav, Totapani, TallaRamnagar, Jeolikote, Mehra Gaon, Chopra gaon, Thaledi	35 dead, 5 injured and 5 missing. 74 House damaged.
		Almora	Rapad-Bhikiyasen, Hiradungri-Almora, Sirad-Almora, Siyaldeh, Banoli	6 dead and 2 injured. 40 House damaged.
		Bageshwar	Kapkot block	6 dead and 1 missing. Tankapur-Pithoragarh NH-125 blocked.
		Champawat	Banbasa, Selkhola, Tilwara, Thuwamuni Patti, Lohaghat	11 dead and 4 injured. 2 houses were damaged. Tanakpur-champawat NH-09 blocked near village Swala and Bhartoli.
		Pithoragarh	Pithoragarh	3 dead and 2 injured
		Uttarkashi	Neelapani and Lamkhaga pass	10 dead, 2 injured and 2 missing
3	Maharashtra	Raigad	TaliyaVillage	84 people died
4	Sikkim	South district	Mamkhola near Melli Bazaar	8 dead, 2 injured. Govt. buildings such as Sr. Sec School, SBS Mellihave been damaged.
5	Kerala	Kottayam & Idukki	Kuttickal&Mundakkayam in Kotayam district and Kokkayar, Idukki district	22 dead, 2 missing and 1 injured

12. Thrust of National Programme

Landslides are becoming more severe in a cascading progression, both in terms of magnitude and frequency of occurrence. This has caused widespread devastation in terms ofloss of life and property, particularly in the fragile mountain environment of the Himalayan and Western Ghats. Its repercussions undermine the mountainous region's development aspirations and provide a heavy setback to the nation's economy.The NDMA has implemented the following initiatives and programmes to address the existing landslide vulnerability.

a) **Pilot Project on Development and Evaluation of Low-Cost Landslide Monitoring Solutions:** NDMA implemented this project in collaboration with IIT Mandi (Himachal Pradesh) and Defense Geoinformatics Research Establishment (DGRE)-DRDO, New Delhi to develop and install low-cost sensors and other instruments for landslide monitoring and EWS through Micro-Electro-Mechanical Systems (MEMS) based sensors technology with the application of Artificial Intelligence, Machine Learning and Internet of Things (IoT). The project successfully developed a low-cost landslide monitoring, warning and prediction system, which needs to be calibrated and upscaled to provide early warning.This low-cost landslide monitoring technology will be beneficial in saving lives and property in the future by providing early warning alerts to the community members and local administration.

b) **Pilot Project on Generation of Meso Level 1:10,000 Scale User-Friendly LHZ Maps and landslide Inventory for Tapovan-Vyasi Corridor of Haridwar-Badrinath National Highway, Uttarakhand:** NDMA is doing this project in collaboration with Remote Sensing Application Centre (RSAC), Uttar Pradesh and IIT Roorkee in which Survey of India (SoI), Geological Survey of India (GSI) and Uttarakhand Government are providing support since June 2018. The prime objective of the project is to create Landslide Hazard Zonation (LHZ) maps of 1:10,000 scale, landslide inventory, and geotechnical analysis of slope forming material.

c) **Training Programmes on 'Landslide Mitigation and Detailed Project Report (DPR) Preparation':** NDMA had conducted training programmes on 'Landslide Mitigation and Detailed Project Report (DPR) Preparation' for officials of the Line Departments of the landslide affected states/UTs and other central government departments through expert institutes such as IIT Mandi (Himachal Pradesh), IIT Roorkee, Indian Institute of Science (IISc), North-Eastern Hill University (NEHU), National Institute of Disaster Management (NIDM), Central Road Research Institute (CRRI), Central Building Research Institute (CBRI), Roorkee, National Institute of Rock Mechanics (NIRM).These training programmesimmensely benefited the landslide-affected states/UTs. The master trainers in the programme also assisted in the preparation of DPRs for landslide treatment and capacity building of other stakeholders. The DPRs received from the concerned States/UTs will be executed and implemented in phases.

d) NDMA released Guidelines on **Management of Glacial Lake Outburst Floods (GLOFs)**,including Standard Operating Procedures (SoP) to deal with GLOFs and Landslide Lake Outburst Floods (LLOFs) in all phases of disaster events. The guidelines were released on 13 October 2020 and circulated to all stakeholders for necessary actions.

e) NDMA is building awareness about landslides and related subjects through print and electronic media, through a weekly panel discussion ('Aapda Ka Saamna') and a programme on 'Landslide Hazard & its Prevention' on the Doordarshan(DD News).

f) NDMA released **the National Landslide Risk Management Strategy in September 2019 inthe Sendai Framework for Disaster Risk Reduction (2015-30)**. This strategy document addresses all the components of landslide disaster risk reduction and management such as hazard mapping, monitoring and early warning systems, awareness programmes, capacity building and training, regulations and policies, stabilization, and mitigation of landslides.The document envisages specific recommendations for the concerned nodal agencies, ministries, departments, states, Civil Society Organizations (CSOs), and other stakeholders to avert or reduce the impact of future landslide calamities.

Some significant challenges faced during the implementation of these initiatives are:

- Multi-hazard ground realities
- Use of inappropriate Early Warning System (EWS) and lack of last-mile connectivity
- Ineffective preparation of plans and projects at the state and district levels
- Absence of techno-legal and techno-financial enabling environment
- Implementation and coordination related issues
- Fewer awareness generation programmes for the public and capacity building ofvariousstakeholders
- Lack of innovative approach in response and relief operations

A brief of these past initiatives has been given in **Annexure D**.

At present, no Ministry/Department of the Government of India has any comprehensive national programme on landslide risk reduction and mitigation for the landslide affected regions of India. Geological Survey of India (GSI), the nodal agency for landslides in the country, has been primarily carrying out landslide mapping and investigation studies in various states. In the past, the Department of Science & Technology (DST) has also been assisting academic and research organizations to carry out studies on landslides of R&D nature. Formulation and implementation of risk reduction and mitigation projects are invariably left to be carried out by the state governments. Most of the states have not undertaken any programme/ scheme for Landslide Risk Management nor have they taken serious action in landslides management, as suggested in the Guidelines issued by NDMA on Landslide Management due to lack of initiatives and resource crunch. Therefore, there is a need for proactive action by the Government of India as the problem of landslides is concentrated mainly in backward and hilly states in North and North-Eastern India. These are also special category states. Invariably, they do not have the resources to formulate landslide risk management projects under the State Plan. Central agencies like BRO carry out mitigation activities regarding landslides on their border roads. Similarly, individual Central Public Sector Units (CPSUs) of the power sector only take up mitigation projects in areas prone to landslides within the power project area.

Section 2(i)of the Disaster Management Act (2005) defines 'mitigation' as measures aimed at reducing the risk, impact or effect of a disaster or a potential disaster situation. Hence, mitigation could be considered as all related measures including large-scale interventions such as the construction of coastal walls, flood embankments, etc. However, these are very resource-intensive measures thatshould be pursued through regular development schemes and not from the mitigation fund. 15th Finance Commission is of the view that mitigation fundsshould be used for the local level and community-based interventions that reduce risks and promote environment-friendly settlements and livelihood practices.

The 15th Finance Commission recommended an allocation of Rs. 13,693 crores under National Disaster Mitigation Fund (NDMF) and Rs. 32,031 crores under State Disaster Mitigation Fund (SDMF). In addition, there is an earmarked allocation of Rs. 750 crores for managing seismic and landslide risks in ten hill states, with an allocation of Rs. 50 crore each to Himachal Pradesh and Uttarakhand and Rs. 50 crores for all the states in the northeast.

To fill in this gap, NDMA has proposed a national level programmewith a holistic approach tomainstream Landslides Risk Reduction and Mitigation for implementation through identification of drivers/project proponents at the national level (e.g., IITs, CSIR, etc.), state level (e.g., NIT, universities etc.), and other stakeholders. This programme is proposed to be driven by science and technology with local-level initiatives to strengthen the state machinery. It aims at providing all the necessary support to the concerned states and UTs for addressing the landslide problem holistically and sustainably. Participation of the local community is essential for the overall project success and enhances ownership of outcomes and infrastructure generated under the programme.

National Programme on Landslide Risk Reduction and Mitigation attains and addresses all elements of prevention, preparedness and mitigation as a means to avert or soften the landslide risk. It covers institutional mechanisms, disaster prevention strategy, early warning system, disaster mitigation, preparedness, and human resource development for landslide risk mitigation and management. Following are the thrust areas of the National Programme on landslides:

- Prioritizing and strengthening early warning, preparedness, prevention and mitigation by leveraging Science and Technology (S&T)
- Integration of space technology inputs into identification, monitoring, and mitigation mechanism
- Holistic landslide risk assessment and mitigation
- Effective implementation of land-use management regulations and policies on the ground
- Developing mitigation measuresforlandslide risk reduction and mitigation in a phased manner
- Bringing together all stakeholders onboard for the management of landslides
- Use of indigenous knowledge alongside scientific knowledge for reducing landslide risk and other related hazards

- Develop landslide monitoring solutions
- Develop mechanical capacities at the state level to strengthen line departments

13. Objectives of the Programme

The National Programme on Landslide Risk Reduction and Mitigation seeks to provide a mechanism to enhance landslide resilience through local-level interventions to address landslide risk and vulnerability effectively. To achieve this goal, the primary objectives of the programme are:

- Prevent the loss of life due to landslide events
- Reduce economic loss due to the landslide impacts
- Strengthening the early warning system (EWS) based on last-mile connectivity
- Strengthening scientific and technical capabilities in landslide risk reduction and mitigation at various levels
- Empower local communities as partners to reduce and mitigate landslide risk

14. Approach

The programme adopts a comprehensive approach to facilitate the implementation of priority actions in the Sendai Framework for Disaster Risk Reduction (2015-2030). Even though this is a national programme, it is the responsibility of each state to plan and execute the programme successfully at the regional and ground level.In this context, enhancing the technical capability of SDMAs and DDMAs in landslide risk governance is vital at the state and district levels.Since this is a community-centric programme, the local community's involvement in allits stages - from the identification of planning strategies and successful implementation – is crucial. Hence, planning and execution of the programme at SDMAs, DDMAs and the involvement of the local community can facilitate landslide risk concerns in the developmental planning and processes of the mountain environment. This programmemay also be integrated with the ongoing skill initiatives of the Government of India likethe Mahatma GandhiNational Rural Employment Guarantee Scheme (MGNREGS), National Rural Livelihood Mission (NRLM), and National Urban Livelihood Mission (NULM)Compensatory Afforestation Fund Management and Planning Authority (CAMPA), toreduce landslide risk and its mitigation.

The national programmewill be implemented in phases aslandslides are site-specific and their vulnerability varies according to the geographical, geological and geodynamic conditions. Overall 15 states have been identified, including2 states from Northern region, 9 states from the Northeast, and 4 from the Peninsula region.

15. Components of the National Programme on Landslide Risk Reduction & Mitigation

A single window will be created for providing funds under the programme. The administrative and technical sanctions of the proposals shall be accorded according to the Government procedures/norms and guidelines released by Ministry of Home Affairs (MHA) for implementation of the National Disaster Mitigation Fund (NDMF) and State Disaster Mitigation Fund (SDMF).Thefourmajor componentsof the programme with their

deliverables are given below:

- Landslide Risk and Vulnerability Assessment
- Landslide Monitoring and Early Warning System (EWS)
- Slope Stabilization
- Awareness Generation and Capacity Building

NDMA may create extra-verticals for inter-agency coordination and collaboration by sharing information amongst the concerned ministries/ departments and institutions through a common platform. The outcomes of the national programme will convergeto create a dedicated centerfor taking appropriate action to reduce future risks. Effective implementation of landslide resilience and risk governance initiatives incoherence with science, practice and policy is required for coherent action for a sustainable mountain ecosystem towards landslides.

16. Project Partners

The concerned ministries, institutes/ organizations, and stakeholderswill provide technical and implementation support to the programme. NDMA will explore the possibility of a partnership with following organizations:

Ministries:

1. Ministry of Mines (MoM),
2. Ministry of Roads Transport & Highways (MoRTH),
3. Ministry of Panchayati Raj (MoPR),
4. Ministry of Rural Development (MoRD)
5. Ministry of Defence (MoD)
6. Ministry of Earth Science (MoES),
7. Ministry of Jal Shakti (MoJS)
8. Ministry of Science & Technology (MoST)
9. Ministry of Environment, Forest & Climate Change (MoEFCC)

Government Organizations

10. Department of Science & technology (DST)
11. Geological Survey of India (GSI),
12. Indian Meteorological Department (IMD),
13. National Remote Sensing Centre (NRSC),
14. Indian Institute of Remote Sensing(IIRS),
15. North Eastern Space Application Centre (NESAC),
16. Border Road Organization (BRO)
17. Central Public Works Department (CPWD)
18. National Highway Authotrity of India (NHAI)
19. Indian Road Congress (IRS)
20. National Rural Road Development Agency (NRRDA)

Academic, Research and Training Institutes

1. Defence Geoinformatics Research Establishment-Defence Research and Development Organisation (DGRE-DRDO),
2. Central Building Research Institute (CBRI),
3. Central Road Research Institute (CRRI),
4. National Institute of Disaster Management(NIDM),
5. Capacity Building Commission (CBC)
6. National Skill Development Cooperation (NSDC),
7. Forest Research Institute (FRI)
8. Central Scientific Instruments Organization (CSIO)
9. Central Soil & Material Research Station (CSMRS)
10. National Institute of Rock Mechanics (NIRM)
11. National Geotechnical Facility Dehradun (NGF-DST)
12. Bureau of Indian Standards (BIS)

This proposal envisages a programmebased approach.Proposals from the states, organizations,institutions,departments, etc. will be appraised financially and technically at the stateand national level before approvalbythe competent authority.

Components:

Component I – Landslide Risk and Vulnerability Assessment

Landslides affect about 12.6% of the Indian landmass aggregating to about 0.42 million square kilometers. States like Kerala, Uttarakhand, and Himachal Pradesh have standard landslide hazard zonation maps on a small scale, categorized as high, moderate, and low zones based on the severity of landslides. These states use high susceptible areas onthe maps to plan and implement landslide risk reduction strategies. However, new risk aspects of landslide have evolved due to climate change uncertainty.Inrecent times, several deadly landslides have occurred in places classified as low or medium risk. This has made planning and strategizing a challenge. Thus, assessing the landslide risk and vulnerability is important to manage, develop and plan activities for susceptible regions.

Landslide risk assessment can be done by evaluating the probability of physical and human loss and other elements at risk in landslide susceptible areas. In addition, evaluating the social and physical vulnerability on a regional scale is essential for assessing the landslide risk. Various qualitative and quantitative methodologies are available for the pragmatic assessment of landslide risk assessment. Hence, it is vital to adopt a standard methodology for assessing the landslide risk at the regional scale using the GIS platform. Already the states like Kerala, Uttarakhand, and Himachal Pradesh have standard land hazard zonation maps on a small scale. Further, NDMA may constitute a Landslide Hazard Zonation (LHZ) Monitoring Committee (LHZMC) to examine and gather information onlandslide susceptibility, risk assessment and existing methods from the stakeholders across the country. This committee will reviewthe quality and outcomes periodically.For conducting landslide, risk and vulnerability assessment

an expert institution/ agency will be identified at the state/district level. Landslide Vulnerability and Risk Analysis will be conducted in high landslide vulnerable districts of states like Uttarakhand, Himachal, Sikkim, Mizoram, etc.

LRVA can be initiated at different levels but for the very high-riskareas, preferably it should be done at the cadastral level.The National Mitigation Programme can support and result in the production of landslide susceptibility maps at the cadastral level.The respective state and local level institutions can be the partner of this initiative.So the result can be attained with the available resource and time.

Some of the proposed activities under the risk assessment are as follows

A. **Landslide Inventory Database**: A landslide inventory is a comprehensive record of the location and characteristics of previous landslides. The Geological Survey of India has created a landslide inventory in the Bhukosh (https://bhukosh.gsi.gov.in) portal and have prepared landslide hazard susceptibility maps under the National Landslide Susceptibility Mapping Programme. Other than this currently, the country does not have a system to track landslide incidents. It is needed to understand how the communities are affected and track the landslide-related loss of life and property at the state level.

   The majority of the landslide-prone states lack a comprehensive database on previous landslides and their characteristics. Furthermore, only a few states have developed landslide susceptibility maps and identified the risk areas. However, these states do not follow any standard and uniform data set and methodologies for creating landslide susceptibility maps. Hence standardized of data set is a prerequisite for the creation of Landslide inventory database. GSI has developed a comprehensive GIS-based database of landslides that is free to download and include field validation for 30,000 landslides. However, this data collection needs to be verified in terms of dates and the type of incidents that occurred.

   States may build a landslide database in consultation with GSI. In this regard standard data set format, suggested by GSI may be followed, with local modifications, as required. States will collect historical and present landslide data, which is not already available in GSI database through SDMAs/DDMAs for building the database.

   Drawing upon these databases of States/UTs and on existing GSI database, a national landslide inventorymay be built by GSI. This database may be improved further as a GIS-based Landslide Information System with user-friendly features, interactive, and field validated data. GSI may set up a system, through whichlandslide can be reported by SDMAs/DDMAs and can be incorporated in database systematically after due field verification. They can also design a mobile application for public reporting, where common people or States or other agencies (like BRO, Army etc.) can inform and update about an incident from the ground and thusdata can be collected for the database.

B. **Develop a GIS Based Slope Information System**: The slope is the most evident factor for the occurrence of any landslide. A GIS-based Slope Information System contains pertinent information on the slopes can be developed for major cities and towns in high-risk landslide-prone areas. This platform can bring all the information regarding the slope such as man-

madeand natural slope, stable and unstable slope, land use types and other physical aspects. The Slope Information System will use the web-GIS platform to offer public real-time, comprehensive slope information that can be used to monitor, plan, maintain and improve theslope stability.This information would be ideal for integrating landslide risk reduction with infrastructure development planning in these urban areas. Slope information may be collected during meso scale mapping of landslide hazards under Sub-Component III.

C. **Develop MesoScale Maps for High Risk Areas:** Mesoscale maps include the maps showing the landslide risk areas of the smallest map unit at a scale between 1:5000 to 1:10000. The creation of meso scale maps includesadetailed field survey in the high-risk areas for analyzing the physical elements causing landslides. The precision and accuracy of the mesoscale mapping will improve by using GIS techniques and incorporating detailed landslide inventory data, all the landslide causative factors, and critical data from the slope information system, existing vulnerable infrastructural activities and cadastral level land use data at the district level.

Landslide Hazard mapping is necessary before planning mitigation measure. It needs to be completed in a time-bound manner. Based on past landslide incidents in States' database, GSI-NLSM data, States may identify high landslide risk area. Then States may choose stretches/area for meso scale mapping in consultation with GSI. To complete mapping in a time-bound manner, States may also appoint any agency for risk mapping in consultation with GSI. The appointed agency will produce a map following the standards developed by GSI for such mapping. After proper quality assurance, GSI may host it in their portal. States may obtain satellite images from NRSC, as per their requirement.

D. **Geo-technical Investigation, Mapping for Vulnerable Existing Infrastructure:**The purpose of Geo-technical investigation is to better understand and analyze the geophysical conditions in high-risk areas to landslide hazards. It will be carried out for existing vulnerable infrastructure like Government schools, college/universities, hospitals, community centres, relief shelters, office buildings, heritage sites, bridges, etc., located in high-risk landslide-prone areas. This investigation will involve geotechnical assessment of the site and appropriate recommendation for mitigation measure. This process will benefit possible retrofitting of the substandard construction with appropriate measures, including drainage correction in existing infrastructure on the mountain head and proper retaining wall in the needed areas, etc. It can also help evaluate the inter-relationship between landscape, geology, geomorphology, slope and respective infrastructure in the landslide areas. The influence of human activities like faulty road construction and unsustainable building construction practices on fragile land and high-risk slopes must be studied in detail and regularly monitored.States may identify social and community infrastructure, which need to be protected from landslide and appoint suitable agency for such study. Based on this study, States may prepare detailed project report for mitigation.

Table 3: Component 1-Expected Output – Outcome and Success Indicator

S.N.	Activity	Output	Outcome	Budget (160 Cr) & Success Indicator
1	Landslide Inventory database	• Developed template/format to record landslide catalogue. • Classification of landslides based on the severity • Collection of historical data including available damage and loss data • Database prepared •	A Nationaldatabase of landslides	Budget – 24 cr Each State/UT will prepare its database, which may be integrated by GSI for a National Database
2	Develop a GIS-based slope information system	• Gathered relevant data on slopes in high-risk locations • Incorporated slope information in a GIS platform	A GIS based slope information system, which will help in resilient infrastructure planning	Budget – 24 cr Each State/UT will prepare own system and ensure its use for by concerned user departments for resilient infrastructure planning
3	Develop meso-scale maps for high-risk areas	• Priority areas/stretches are mapped at meso scale • Identified various elements exposed to landslide risk • Mapped all causative factors for landslide occurrence • High-resolution satellite data, Digital Elevation Model and LiDAR data is used for cadastral level mapping • Compiled and evaluated data on risk scenarios	Meso Scale map of identified high risk area	Budget – 88 cr 7700 km (or equivalent area) stretch are mapped *#
4	Geo-technical investigation of existing vulnerable infrastructure activities	• Priority infrastructures in high-risk areas are identified • Geotechnical evaluation of the site • Recommended mitigation measure	A Geotechnical Evaluation report with recommended mitigation measures of each such infrastructure	Budget – 24 cr As number of infrastructure identified by States

*****NDMA's pilot project on meso–scale mapping at Tapovan-Vyasi corridor, Uttarakhand incurred Rs. 29 Lakh for a stretch of 27 Km; accordingly, average cost of mapping is estimated to be Rs. 1 lakh/km (approx.).

 # This activity will be taken up additionally to what GSI undertakes from its own budget

Component II - Landslide Monitoring and Early Warning System (EWS)

Landslide monitoring and early warning have effectively reduced disaster risk and the loss of life. A landslide early-warning system (LEWS) can model landslide occurrences and promptly warn about impending danger. Depending on the type of landslides, the target warning area, and the communities to be warned, it can be of different types.Landslide monitoring can provide insight into understanding the dynamics of landslide movement and also detect or forecast landslide behaviour.

The country's current landslide and early warning systems are unable to connect to

thelastmile. Also, there is hardly any successful attempt at real-time monitoring of landslides. Hence,the existing system needs to be modified and developed inconsultation withexpert departments and agencies.

Recently IIT Mandi, Central Building Research Institute (CBRI), AMRITA University, and DefenceTerrain Research Laboratory (DTRL) have taken promising initiatives for developing technology for landslide monitoring and early warning but development of reliable EWS needs more research. They have pilotedsensor-based technologies/instrumentation for monitoring landslides in different parts of the country. This needs to be further upgraded for continuous dissemination of alerts and warnings available to the local platform with the integration of various government departments. There is also a need to develop an indigenous multi-purpose Early Warning System (EWS) based on rainfall threshold, ground movements, etc. The research and development and the pilot project should focus on developing indigenous technology(s).The technology should focus on wider applications for transmitting information inremote regions.

The four major pilgrimage centers in Uttarakhand, namely Kedarnath, Badrinath, Yamunotri, and Gangotri (also known as "Char Dham") and other significant tourist attractions of Himachal Pradesh, Mizoram, and Kerala are located in landslide-prone zones. Recurrent landslides in these areas are a result of frequent heavy rainfall. Many pilgrims and visitors are exposed to the possibility of landslides in these regions. As a result, developing an indigenous landslide monitoring and Early Warning System (EWS) for these locations should be prioritized.

The proposed activities come under landslide monitoring and EWS are as follows:

a. **Sensor Based Local Early Warning System (EWS)**: The design of a landslide community-centric early warning system is critical in protecting people living in landslide-prone areas. The landslide early warning system must be implemented with a low-cost, simple technology that is easy to understand, operate, and maintain by the local community. Hence, the Science & Technology tools such as Mobile Phone Applications, Automatic Rain Gauges (ARG), Automatic Weather Stations (AWS), wireless sensor networks, web GIS Interfaces, sirens etc. will be explored. For this, NDMA will harness institutional expertise to develop community-based Early Warning Systems with last-mile connectivity. Major steps in establishing a community-based landslide early warning system include understanding the hazard susceptibility of the area, developing a monitoring strategy, and involvement of the local community. This system may comprise extensometers, soil moisture sensors, rain gauge stations and solar panels as an energy source.

   Surface-level motion sensor-based systems may be developed for landslide Early Warning Systems. The system uses data generated from previous landslides and rainfall in the region to predict the possibility of slope movement. The multiple sensor-based systems gather information about weather parameters,pore water pressure (pressure of groundwater held within the soil), vibrations, soil moisture, soil movement, and slope instability. The collected data is transferred to an associated computer system for persistent

storage in the monitoring station. It monitors and detects landslide occurrences and sends the appropriate warning messages to the control room at various levels.

According to meso-scale mapping States may identify sites, and type of mitigation measure ranging from EWS to slope stabilization. States may call for Expression of Interests (EoI) from universities/institutes/agencies, which are working in this subject area and appoint implementing agency for the EWS following due procedure.

It may be noted that early warning at any site is a continuous process until the completely unstable slope of landmass fails or any slope stabilization measure is adopted or the vulnerable people and existing infrastructure are shifted to a safer place. Therefore, a long-term plan and budget support for maintenance of EWS is required. Hence, the implementation contract needs to have a long-term perspective for maintenance. The implementing agency needs to have the capacity to support it for longer period.

b. <u>Landslide Monitoring and Development, Integration & Dissemination (DID) of Hazard information:</u>Dissemination of disaster warnings to the community level can be managedby coordinating with the control rooms at the designated agencies of the state, district and the local level (block/village).The transmission of warning messages through Short Message Service (SMS) and the siren facility wouldbe appropriate to ensure the last mile connectivity.As part of this, it is necessary to sensitize the local community on how to receive and respond to the warning from the designated agencies of the government.The system will be connected through a local mobile network for data transmission. Developing and using the latest technologies like mobile phone applications to monitor and disseminating warning for landslides will also help supportDigital India. Artificial Intelligence (AI), Internet of Things (IoT) and machine learning models in generating effective and reliable early warning alarms can be integrated into a Web GIS platform that provides effective tools for disseminating alerts.

States may develop a GIS-based decision support system for landslide monitoring by integrating early warning systems. In addition, it may be integrated with Common Alert Protocol (CAP) of NDMA for dissemination of alerts.

Further RADAR Technology for Landslide Monitoring and Landform Deformity may be used for regional scale early warning, which is being developed by GSI and **NRSC.**Rainfallisone of the most common triggers landslides in many places in the country. The rainfall records over sufficiently large periods are essential for assessing detailed landslide analysis.Presently the rainfall data are measured in individual meteorological stations, which are limited in number. The use of weather RADAR of rainfall data can overcome the conventional data limitation. The deployment of Doppler RADAR can be integrated with the IMD, as the organization is dealing with the weather forecast.Combining the RADAR and Small Satellite Constellation from the sun-synchronous low Earth orbit (LEO) will be an ideal technique for Landslide monitoring Weather RADAR data and the live satellite maps can be successfully used in real-time observations for rainfall triggering areas and landslides caused by short duration and intense rainfall. Synthetic Aperture Radar (SAR) technology

plays a vital role in rapid landslide monitoring by the high precision assessmentof the ground surface displacement fields. The technology has many advantages as it works through cloud, day and night observation with wide area coverage. The SAR technology can be utilized for early detection, continuous monitoring, and risk assessment of landslides. The agencies like NRSC-ISRO/ GSI will handle the overall coordination of these technologies, and the relevant information can be disseminated adequately to state and regional institutions. States may use this regional warning for dissemination when as soon as it is available.

Table 4:Component II-Expected Output and Outcome

SN	Activity	Output	Outcome	Budget (220 cr) and Success Indicators
1	Sensor-Based Local Early Warning Systems	• Sites for local EWS identified • Designed and installed an early warning system	Local EWS installed at chosen site	Budget – 165 cr Number of sites, where EWS installed
2	landslide monitoring and Development, Integration & Dissemination (DID) of hazard information	• Integration of EWS for monitoring landslide and generation of alert • Ensured last mile connectivity through SMS and sirens	Established a system of continuous monitoring of landslides and dissemination of warning	Budget – 55 cr Alert dissemination from all EWS established

* Cost of NDMA funded pilot project on EWS developed by IIT Mandi was Rs. 28 Lakh. The site was an area of 500 sqm. (approx.).

Component III: Slope Stabilization

Landslide affects human beings, but it is also a major cause ofthe destruction of nature, economy and regional development. Therefore, there is an immense need for a project to mitigate landslides by showcasing the best practices in landslide risk mitigation. The country lacks a comprehensive landslide mitigation programme to address the landslide risk in the country until now. At present, no ministry/ department of the Government of India has any full-fledged project on landslide risk mitigation. In this context, NDMA has conceptualized and drafted the Landslide Risk Mitigation Scheme (LRMS) for the major landslide-prone states in the country. The first phase of this scheme is beingimplemented in Nagaland, Mizoram, Sikkim and Uttarakhandto provide necessary techno-financial support. This large-scale project with crores of investment to mitigate site-specific landslides isalso beneficial for the local community. The next phases of LRMS will be supported and implemented by NDMA with fund sharing between the centreand states as per the existing norms.

It is now proposed that the states should identify strategies for slope remediation, landslide treatment, and community rebuilding through local interventions and indigenous best practices such as drainage channelization, vegetation, and Chal Khal (artificial water storage for agricultural practices)etc.The states/ concerned agencies will be requested to identify the most vulnerable landslide sites that requireimmediate mitigation measures. Mitigation of landslide sites will be done based on the proposal submitted by the concerned states in conjunction with already running Govt. of India programmes such as MGNREGA, Skill Development, etc., through the block development Department, Panchayati Raj

Institutions, Village Development Boards (VDB)/ Village Councils, etc. The cost of the proposal preparation by the State Govt.s/UTs shall be borne by project proponents after getting approval of the project by TAC/ TEC based on Cost-Benefit Analysis (CBA) having suitable local mitigation measures. The States/ UTs (SDMA's & DDMA's) shall be responsible for the quality of the work done under the scheme. TEC experts will review the site inspection and quality of work with the help of a third-party audit. This will ensure that work done builds back better and safer systems.

Following are the recommended activities under Component-III:

a. **Community-Based Slope Stabilization by Local Interventions**: Most of the landslides in the country are triggered by rainfall. One of the major causes of shallow landslides is the faulty management of surface drainage. Community-based drainage management and correction areessential to collect and redirect surface water runoff to prevent soil saturation in very high rainfall areas prone to landslides. Community engagement expertise and active participation will be ensured at every step of the surface water management on a high-risk slope. The methods that can be adopted include construction of diversion waterways, designing drainage systems to run along natural drainage lines, sealing of tension cracks, rip-rap (stone or vegetative or combined) of the waterways, disposing of the diverted runoff safely in the stable natural drainage system and regular cleaning of drainage and prevention of leakage in the diversion channel. Sub-surface drainage methods will also be designed and implemented considering the local geography and slope to reduce pore-water pressure along the fragile mountain slope. As a result, the local community will be benefited from short-term employment, capacity building and expertise in effective slope drainage management practices and can enable community ownership in landslide solutions. This component can be implemented in convergence with Mahatma Gandhi National Rural Employment Guarantee Scheme (MGNREGS).

b. **Bio Restoration/Bio Engineering Measures:**Bio restoration/Bio Engineering is a vegetative method for stabilizing slopes using indigenous plant species. This method will be adopted in areas where shallow landslides are common due to the unscientific alteration of natural landscapes. This bio restoration protocol will be developed through scientifically validated methods for identifying native species based on various characteristics of plants viz, depth of the root system, soil holding capacity, anchoring and binding capacity of the plant, etc. This method can stabilize slopes and curb landslides in an eco-friendly manner. For this componentStates' Forest department, Environment department and Ministry of Environment, Forest and Climate Change will be the major stakeholders

c. **Site-Specific Structural Measures for Landslide Mitigation:**A holistic approach is required to reduce the severity of landslides based on local specific structural mitigating solutions. The identification of appropriate structural measures should be based on the feasibility of the site-specific implementation, including social and environmental acceptability. The standard structural measures' acceptability may vary from immediate and absolute long-term correction to minimal control for a short period. Stabilization of support techniques includingretaining wall,gabion wall,reinforced earth walletc. will be appropriately adopted.Ground inclusions like

soil nails and rock bolts are also crucialfor stable foundations.Soil improvement techniques, including grouting and geo-grids,make the soil stableon unstable slopes.Slope alteration techniques like removing material from the top of the slope and filling the toe of the slope to give support, benching, etc. will be effective for steep slope failures.Various appropriate structural drainage correction measures such as culverts, drains/ditches,and causeways should be adopted based on the feasibility of the local geography.

d. Strengthen by- laws, Building Regulations and Rules to Improve the Resilience of the Built Environment: Disaster resilience in the built environment is broadly covered by the National Building Code, National Standards and Codes of BIS, Vulnerability Atlas of the Building Materials and Technology Promotion Council (BMTPC) and related guideline documents of the NDMA for landslides and earthquakes. Many internationally accepted Indian Standard Codes on design and construction are available to address building construction related vulnerabilities for earthquakes and landslides. However, no state has adopted model site development and slope modification standards to address landslide or earthquake hazards in hilly areas. Only two local jurisdictions in the country, i.e. Aizawl Municipal Corporation (AMC) and Mussoorie Dehradun Development Authority, have regulations to control slope cutting. These can be a good model for other regulatory bodies in landslide-prone areas to follow. Based on the prevailing vulnerabilities and risk scenarios, these types of locally specific regulations may be developed and adopted for all the hazard areas. Hazard resistant elements should be incorporated in all the states' current building rules and regulations for hazard sensitive land management and resistant construction as per the applicable national standards. Thus, appropriate national standards of resistant elements will be incorporated into all states' existing building rules and regulations for disaster resilient land use and building development.

This component is the most critical part of this programme. It needs a proper system of implementation. States will identify sites for slope stabilization based on hazard, vulnerability, andexposure risk analysis. They may assign preparation of detailed project report (DPR) including site-specific geotechnical analysis, slope stability modeling, to any agency/institute following due process. After approval of DPR, implementing agency may be selected following due procedure. Simultaneously States will recommend enactment of land use regulation and consider modalities of enforcement thereof during the programme period.

In addition, it should be noted that every site cannot be mitigated for landslide risk, for example, where landslide is deep-seated or it is triggered by a regional scale geological factor. Hence a cost-benefit analysis should always be carried out before taking up any mitigation activity especially installation of aEWS or other costly structural mitigation measures. Rehabilitation may be a simpler and optimized solution sometimes.

Table 5:Component III-Expected Output and Outcome

S.N.	Activity	Outcome	Output	Budget (550 cr) and Success Indicator
1	Community-based slope stabilization by local interventions	• Managed drainage and corrected mountain slopes • Constructed diversion waterways, designing drainage systems to run along natural drainage lines	Enhanced adaptive capacity and create awareness in landslide risk management	Budget – 110 cr
2	Bio restoration/Bio engineering measures	• Indigenous plant species for slope stabilization are identified • Bio restoration protocol developed • Strengthened eco-friendly strategies for landslide mitigation	Stabilized high-risk mountain slopes	Budget – 165 cr
3	Identification and adoption of site-specific structural measures	• Conducted a feasibility study on social and environmental acceptability • Identified appropriate structural measures	Implemented structural measures at identified sites	Budget – 253 cr
4	Strengthen landslide risk aspects in the states, building rules and regulations to improve the resilience of the built environment	• Reviewed the existing building rules and regulations of the states • hazard resistant elements in the existing rules and regulations is incorporated • Conducted a feasibility study on adoption of slope modification regulations of the Aizawl Municipal Corporation (AMC) in other landslide-prone regions in the country	Enforced Land use regulation	Budget – 22 cr States review building rules and land regulations, and enact necessary regulations

#Based on data from LRMS pilot projects it is found that slope stabilization was done for an area of 30000 sqm., on average at a cost of 14 cr; however it depends on many other factors , so it is indicative only

Component IV: Awareness Generation and Capacity Building

The lack of comprehensive understanding and awareness about the landslide risk among the public and many stakeholders in India is the major cause of severe losses during landslides. In this context, awareness generation and capacity building are crucial for addressing and reducing landslide risk and accelerating initiatives in the various phases of disaster management, such as preparedness, mitigation, response, and rehabilitation. Awareness and capacity building programmes will be successful with the involvement of local communities, research institutions and authorities such as district administration, Panchayat Raj Institutions (PRI)and local communities are maximized.

Capacity building is an ongoing process that equips officials, stakeholders and the community to perform their functions better for landslide risk management. National Institute of Disaster Management (NIDM) is the prime focus for various capacity-building programmes at the national level. Department of Science and Technology (DST), Government of India and Wadia Institute of Himalayan Geology (WIHG), Dehradun and Geological Survey of India also conductresearch and development programme on landslide risk reduction. Additionally, various state-level scientific institutions and universities are undertaking research on landslide risk reduction.

Various states have training institutes engaged in training and capacity building in disaster management for state-level officials. However, there is a lack of capacity building initiatives at the grassroots level.Therefore, the capacity building initiatives should be focused at the grassroots level, officials from the District Administration, Panchayati Raj Institutions (PRI) representatives, and local communities.

This component will have following three sub-components:

A. Sensitization Programmes for the Panchayati Raj Institution members and in the landslide-prone areas:

A capacity-building programme will be conducted for elected representatives from Panchayati Raj Institutions (PRI) to enhance adaptive capacity and create awareness of landslide risk management. The training programme will provide knowledge through field-oriented methods in the post landslide location. The scientific aspects of landslides will be described during the field study by observing various characteristics of landslides.

Community participation in various landslide risk mitigation strategies is critical can reverse the landslide impacts, build a safety culture, and ensure sustainable development in mountainous areas. The local community will be empowered with various sensitization programmes on the landslide risk reduction and management. The sensitization programme will be tailored by the development of practical knowledge about landslide phenomena, such as the major causes behind the landslides, identification of vulnerable zones, recognition of landslide signs, development of landslide prevention and mitigation techniques, and the need of adopting sustainable land use and construction practices in the mountain slope. These programs must be conducted regularly to improve the awareness and readiness of the local community for any possible landslide occurrence. NGOs working in disaster risk reduction in the mountain areas will be assigned to facilitate the programme.

A village/municipality level task force must be established in high landslide vulnerable districts to support the community in disaster mitigation and preparedness in the mountainous areas. The members of the community task will be representatives from the Panchayat Raj Institutions, local community groups (farmers groups or any such other livelihood groups), and volunteers from the youth groups. NGOs working for disaster risk reduction and mountain environment protection can be assigned to facilitate this initiative. Training will be given to the village task force members on landslide early warning, identification of pre landslide situations, rescue and evacuation operations, etc. The preparation of a Community Disaster Management Plan will be one of the responsibilities of this task force. They may further sensitize all villagers/communities/families at the grassroots level.

NIDM will prepare a detailed scheme of such training/capacity building programme in consultation with stakeholders. States may conduct this sensitization and awareness generation programmes with the support of identified SIDM/other agencies/institutes/NGOs at the regional and local levels. One such training programme has to be conducted in each identified landslide prone village/municipalities annually. Also, States may create a community village taskforce for landslide-prone areas converging it with ‘Aapda Mitra’ Scheme of NDMA.

B. Sensitization Programmes for state and district level officers in the landslide-prone areas:

The government department's lack of trained human resources will be a major challenge in implementing appropriate landslide risk management strategies. Therefore, different government stakeholders must be sensitized and capable of dealing with the landslide risk under their jurisdiction. Training and capacity development awareness of government officers at the state and district level are required to improve organizational and capability skills to deal with landslide risk situations. A wide range of management skill training is essential for potential officers to plan for specific landslide-related activities. The training can be imparted through various identified training institutes in the state and district level. Training modules on landslide risk reduction should be developed. SDMA's and DDMA's can arrange and identify landslide training programmes for targeting officers from Revenue, Geology and Mining, Irrigation, Rural Development, Building and Housing, Police & Civil Defence, Fire Service, Soil Conservation Department, Ground Water Department, Town and Country Planning and Local Government Engineering Department and other nodal departments. This helps to enhance knowledge and skill to landslide the risk of the government department from an administrative point of view. At the same time, a special awareness campaign for the disabled, aged people, children, and economically disadvantaged rural populations is also necessary.

NIDM will prepare a detailed scheme of such training/capacity building programme in consultation with stakeholders. States may conduct this sensitization and awareness generation programmes with the support of identifiedSIDM/other agencies/institutes/NGOs at the regional and local levels. One such training programme has to be conducted in each identified landslide prone districts annually.

C. Research and Development (R&D) (Small grant window): This programme aims to invest in research and development activities to promote innovation at national level. Research grant will be provided to Universities/Institutes to promote innovations in landslide risk mitigation. **Activities should be related to :**

a. Early warning system,
b. Network telemetry
c. Development/improvement of BIS codes,
d. Bio Restoration
e. Bio-engineering
f. Engineering Solution
g. Risk assessment
h. Capacity building in landslide risk management
i. Application of Information Technology and remote sensing in landslide risk management
j. Any Non-Structural Measures

NDMA will prepare detailed terms of reference in this regard. After circulation of the terms of reference, Universities/Institutes may send proposal to NDMA for appraisal. NDMA may request the state, where the University/Institute is situated to release the fund as per extant NDMF guidelines. In case, the fund is insufficient for the State, NDMA may ask any other States, having highest amount of balance fund for this sub-component, to release the fund from NDMF as per

extant NDMF guidelines.

Table 6:Component IV-Expected Output and Outcome

S.N.	Activity	Outcome	Output	Budget (70 cr) and Success Indicators
1	Capacity building programme for the Panchayati Raj Institution members in the landslide-prone areas Creation of a community village task force for landslide preparedness	• Developed training modules • Prepared a booklet with information on landslide awareness in local languages • Identified target participants among the elected members from Panchayat Raj Institutions (Local bodies) • NGOs/institutes for facilitation of training programme are identified • Conducted site visits in the past landslide locations • Recognized the role and responsibilities of different stakeholders • Constituted a village task force in each village • Villagers are sensitised about the hazard, vulnerability and elements at risk in their respective villages and surroundings. • Conducted regular training sessions for specific skill development. • Ensured effective and prompt action to rescue and respond in the event of a disaster. • Developed skills of the community through Indigenous knowledge and methods	Enhanced adaptive capacity and create awareness in landslide risk management Local community is better prepared for landslide mitigation	Budget – 14 cr Necessary raining programme is conducted in each identified landslide prone village/municipality. A task force is created in each identified village
2	Capacity Building Programmes for state and district level officers	• Government officials are sensitized about the landslide risk under their jurisdiction • Training institutes are strengthened on landslide risk • Improved organizational and capability skills to deal with landslide risk situations	Enhanced administrative knowledge and skills of the government department on landslide risk	Budget – 5.6 cr Necessary Training programme is conducted in each identified landslide prone districts..
3	Research and Development	• Supported individual scientific studies on landside • Facilitated the creation of knowledge sharing, networking and publication on landslide risk reduction	Some indigenous measures developed	Budget – 50.4 cr Some indigenous measures developed

Coverage of States

The programme will be focused on landslide-affected states in a phase wise manner Based on the landslide susceptibility, exposure, and vulnerability of the landslide occurrence in the country, it is proposed to be implemented in Fifteen states and two UTs in phase one.

The States included in this phase are Himachal Pradesh, Uttarakhand, Sikkim, West Bengal,Assam, Manipur, Tripura, Arunachal Pradesh, Nagaland, Mizoram, Megahalaya, Maharashtra, Karnataka, Kerala and Tamil Nadu. In addition, two UTs viz. Jammu & Kashmir and Ladakh have been included. These States and UTs have been selected based on area vulnerable to landslide (as available from'National Landslide Susceptibility Mapping (NLSM)' data of GSI, Annexure-A) and its exposure**. The districts have been indicated here on the same ground for each State. However, the States may prioritize districts based on their own assessment of risks in consultation with NDMA.**

NDMA will submit another proposal for the subsequent phases covering the remaining states affected by landslides and other mountain hazards. Details of the selected states and the districts are given in the following table:

Table 7: Project Implementing states and districts for phase 1

Northern Himalaya		Northern Eastern Himalaya		Western Ghats	
States/UTs	District	States/UTs	District	States/UTs	District
Himachal Pradesh	Chamba	Arunachal Pradesh	Upper Subansiri	Maharashtra	Pune
	Mandi		Anjaw		Ratnagiri
	Kinnaur		Papum Pare		Thane
	Shimla		West Siang		Raigarh
Uttarakhand	Uttarkashi	Sikkim	North District	Tamil Nadu	Nilgiris
	Chamoli		West District		Coimbatore
	Pithoragarh	Nagaland	Mokokchung	Kerala	Wayanad
	Almora		Phek		Idukki
			Kohima		Pathanamthitta
			Peren	Karnataka	Kodagu
West Bengal	Darjeeling	Mizoram	Aizawl		Chigmangloor
	Kalimpong		Champhai		
			Serchhip		
			Saiha		
		Meghalaya	East Khasi hill		
			West Khasi hill		
		Manipur	Ukhrul district		
			Tamenglong district		
		Assam	Cachar		
			Dima Hasao		
		Tripura	Dhalai		
			North Tripura (Old)		

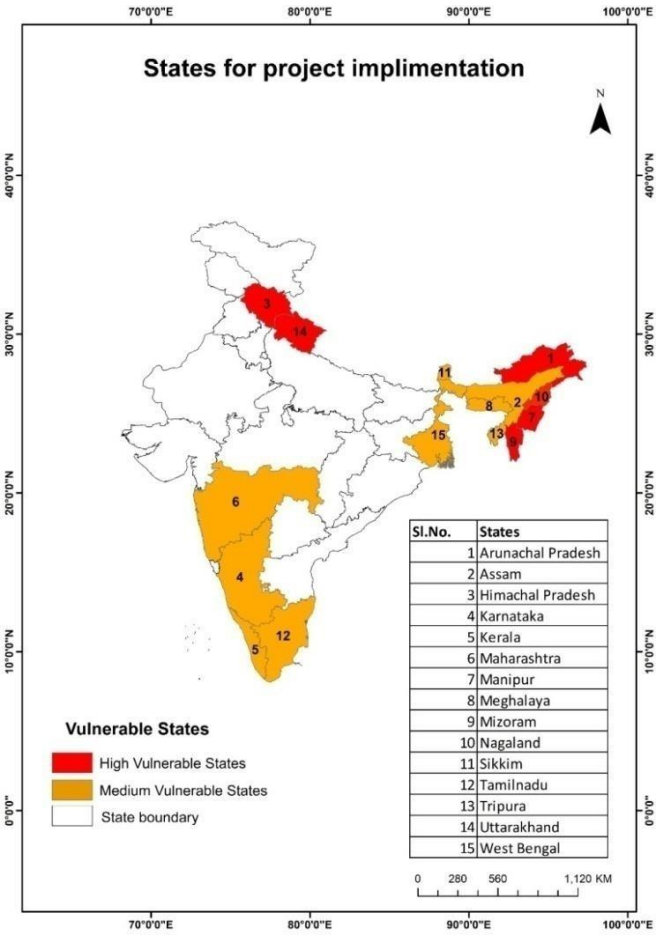


Figure 3: Landslide vulnerable states of India

Eight vulnerable districts have been selected from North Himalayan region. In this, four districts are from the state of Himachal Pradesh and four districts from the Uttarakhand.

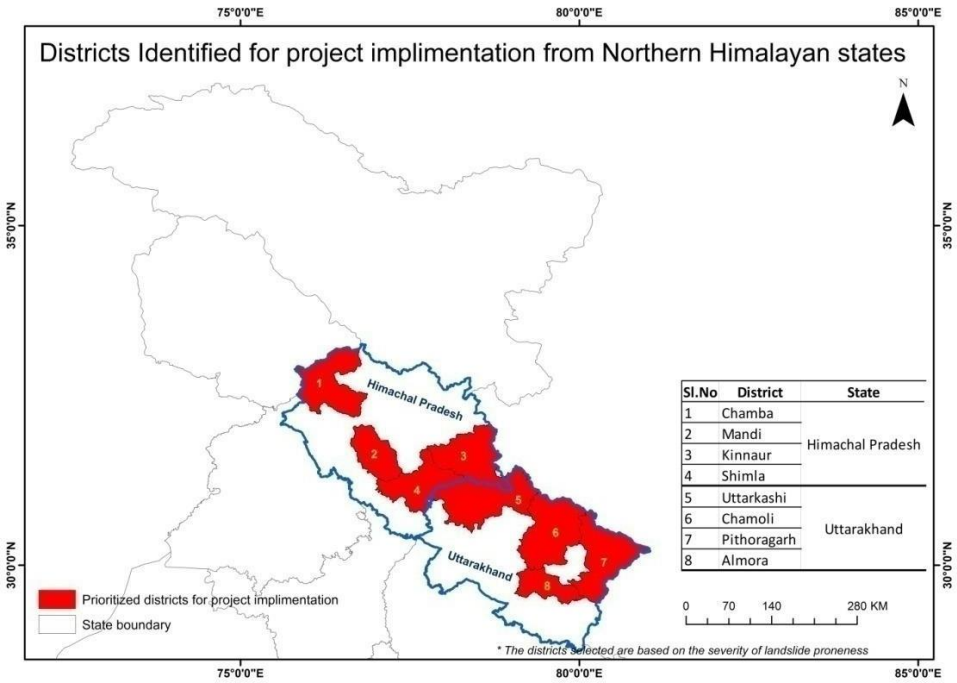
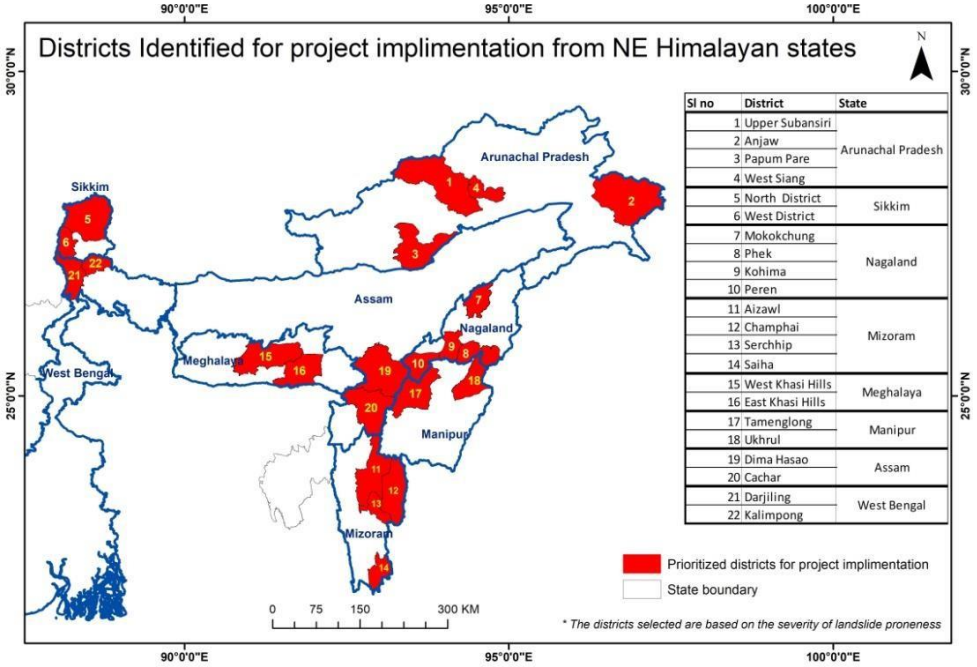


Figure 4: Vulnerable districts of Himachal Pradesh and Uttarakhand for project implementation

In the North-eastern Himalayan region, eights states have been identified in which 22 most vulnerable districts are covered. In this, four districts each from Arunachal Pradesh and Mizoram,and Nagaland, two districts from Sikkimand two districts each from Assam, Manipur, Meghalaya and West Bengal have been selected for implementing the programme.



Sl no	District	State
1	Upper Subansiri	Arunachal Pradesh
2	Anjaw	
3	Papum Pare	
4	West Siang	
5	North District	Sikkim
6	West District	
7	Mokokchung	Nagaland
8	Phek	
9	Kohima	
10	Peren	
11	Aizawl	Mizoram
12	Champhai	
13	Serchhip	
14	Saiha	
15	West Khasi Hills	Meghalaya
16	East Khasi Hills	
17	Tamenglong	Manipur
18	Ukhrul	
19	Dima Hasao	Assam
20	Cachar	
21	Darjiling	West Bengal
22	Kalimpong	

Figure 5: Vulnerable districts of Arunachal Pradesh, Sikkim, Nagaland, Mizoram, Meghalaya, Manipur, Assam and West Bengal for project implementation

The most vulnerable landslide-prone districts have been selected from the Western Ghats region covering 11 districts from four states. This includes four districts from Maharashtra, three from Kerala, and two each from Tamil Nadu and Karnataka.

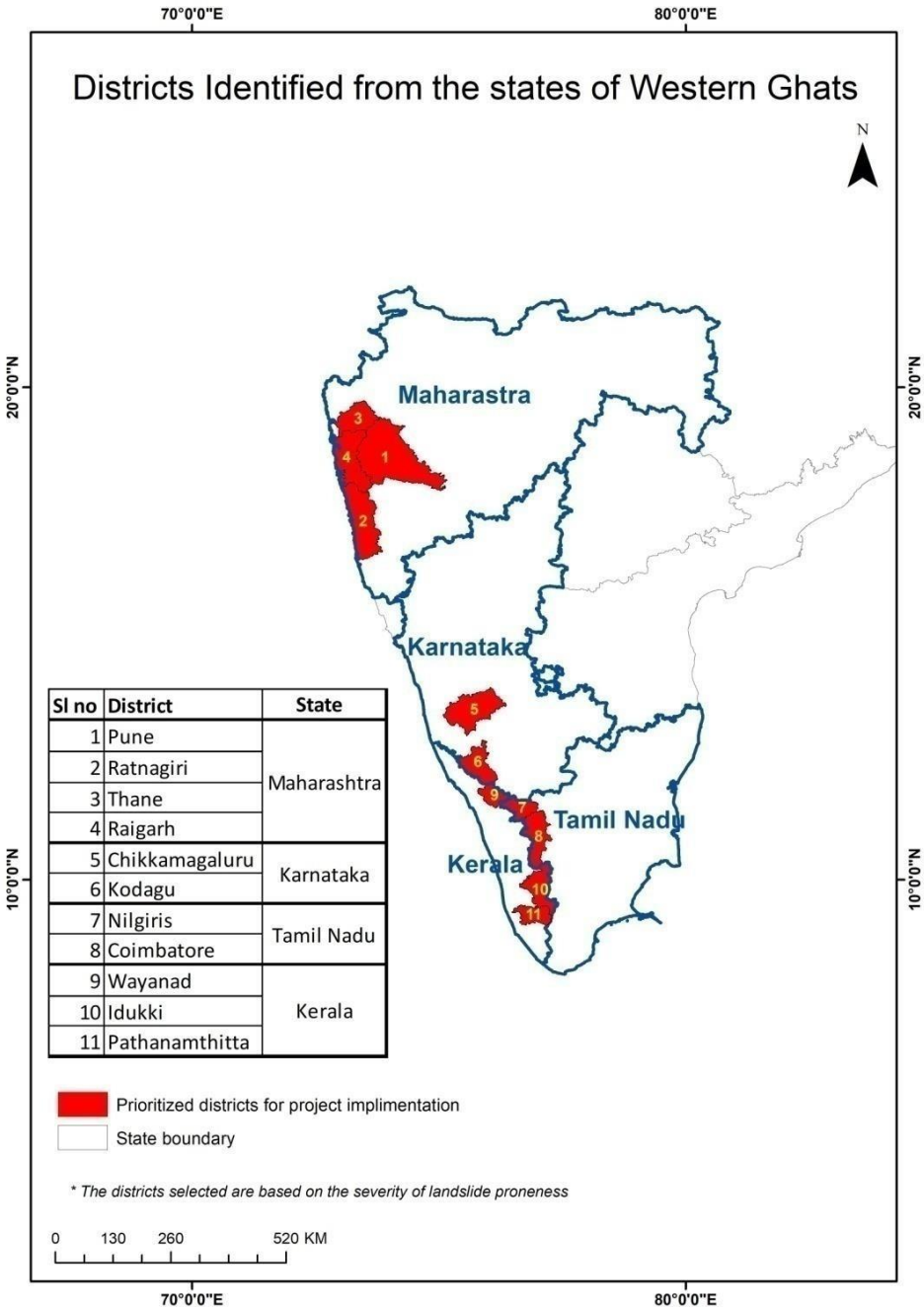


Figure 6: Vulnerable Districts of Maharashtra, Karnataka, Tamil Nadu and Kerala for Project implementation

In Phase –I of the programme, 49 [additionally 4 districts each from UT of Ladakh and J&K and 2 districts from West Bengal have been identified, as mentioned in Table-1 of executive summary] landslide-vulnerable districts from fifteen states have been indicated above. However, States may choose more districts based on merit in consultation with NDMA.

This programme was also intended to be implemented for UTs of Jammu & Kashmir and Ladakh as well in all its components with Rs.30 cr allocated to each. However, these funds are to be appraised by J&K Division of MHA and provided for from budget heads available to it.

Budget

- The Government of India has a policy commitment to reducing disaster risk by mitigation strategy. The 15th Finance Commission recommends setting up Mitigation Funds at the national and state levels as the National Disaster Mitigation Fund and State Disaster Mitigation Fund consist of 20% of the National Disaster Risk Management Fund (NDRMF) and State Disaster Risk Management Fund (SDRMF), respectively. The Finance Commission has allocated resources for the National Disaster Mitigation Fund and State Disaster Mitigation Fund. In this context, to address the landslide risk, the Government of India has initiated a flagship programme National Landslide Risk Mitigation Programme (NLRMP). The 15th Finance Commission (XV-FC) has recommended Rs.32,031 crore (20 % of the State Disaster Risk Management Fund (SDRMF) of Rs 1,60,153 crore) for SDMF of States.
- The total budget for all the activities for the Programme (NLRMP) in Phase-I is proposed to be ₹1000 crores (comprising Rs. 900 crore from NDMF and 100 cr as States' share upto 31 March 2026 (Table 8). The programme will be funded from NDMF for States. States' share will be applicable as per extant NDMF guidelines. Details of allocation for components of the programme in terms of percentage of total programme outlay are given in the following table::

Table 8: Total budget for National Programme

Component	Activities	Sub-component Ratio in %	Component Ratio in %	Sub-Component Amount (Rs. Cr)	Component Amount (Rs. Cr)
1. Landslide Risk and Vulnerability Assessment	1. Creation of Landslide Inventory database	15	**16%**	24	160
	2. Developing a GIS-based slope information system	15		24	
	3. Developing meso-scale maps for high-risk areas	55		88	
	4. Geo-technical Investigation and Mapping of vulnerable existinginfrastructure	15		24	
2. Landslide Monitoring and Early Warning System	1. Sensor Based Local Early Warning System (EWS)	75	**22%**	165	220
	2. Landslide Monitoring and Development, Integration & Dissemination (DID) of hazard information	25		55	
3. Slope Stabilization	1. Community-based slope stabilization by local interventions	20	**55%**	110	550
	2. Bio restoration /Bio-Engineering Measures	30		165	
	3. Site-specific structural measures	46		253	
	4. Enacting and enforcement of building rules and regulations	4		22	
4. Awareness Generation and Capacity Building	1. Sensitization Programmes for communities and the Panchayat Raj Institution members including creation of a village task force in landslide-prone areas	20	**7%**	14	70
	2. Sensitization Programmes for state and district level officers in landslide-prone areas.	8		5.6	
	Research and Development (Small grant window)	72		50.4	
			100%	1000	1000

Allocation of fund among components/sub-components have been mentioned in terms of percentage of gross allocation. States will divide allocated fund among components and sub-components as per ratio shown in Table 8. There could be flexibility for re-allocation of fund across sub-components of a component by States as per respective requirement; however, the fund allocation across components may be inter-changeable only with approval of NDMA on reasonable ground shown by the State. States should spend minimum 50 % of allocated fund for component- III (Slope Stabilization) of the programme.

 The state-wise details of allocations for the period from FY 2023-24 to 2025-26 (Phase 1) is given in Table 9:

Table 9: State-wise Budget Allocation

Sl. No	States Earmarked States @	Centre share (Rs in crore)	States' share (Rs in crore)	Total Budget
1	Uttarakhand	125 #	14	139
2	Himachal Pradesh	125 #	14	139
3	Mizoram	45*	5	50
4	Nagaland	45	5	50
5	Manipur	45	5	50
6	Arunachal Pradesh	45	5	50
7	Sikkim	45	5	50
8	Meghalaya	45	5	50
9	Assam	60	7	67
10	Tripura	10	1	11
	Non–Earmarked States $			
11	Maharashtra	90	10	100
12	Karnataka	65	7	72
13	Kerala	65	7	72
14	Tamil Nadu	45	5	50
15	West Bengal	45	5	50
	Total	**900**	**100**	**1000**

[#For the State of Uttarakhand and Himachal Pradesh the amount of 125 crore will be given from earmarked allocation only.
*for eight North-eastern States (sl. no 3 to 10), out of total allocation of Rs. 340 crore, Rs. 125 crore will be given from earmarked allocation, and rest Rs. 215 cr will be given from non-earmarked fund.
@ Total earmarked allocation for this programme is Rs.375 crore.

$ The remaining amount of Rs. 525 Crore is a non-earmarked fund, which will be allocated from regular NDMF.

Also, there will remain scope for further allocation of funds from NDMF based on States' performance. States are encouraged to utilize resources from SDMF also to enhance the scope of landslide risk mitigation in line with this national programme.

The fund will be released in three instaiments of 30%, 40% and 30% of the total approved amount, subject to utilization of 75% of the previous fund released. The fund disbursement for the projects should not be beyond 31st March 2026. In addition to the budget, the fund flow for the project activities will be linked to outputs and released in tranches as agreed by implementing partners. NDMA will have the authority to take all the financial decisions concerning unspent allocation or extension of projects with the approval of the Ministry of Home Affairs (MHA).

The release of the funds shall be subject to the submission of the following documents:

- Utilization Certificate for the funds released earlier, quarter-wise in the form prescribed.
- A Certificate regarding the requisite physical completion of works.
- A **c**ertificate that the grant released to the Scheme will be used for non-relief works only.
- A certificate that the state has a necessary budget provision in its Plan to incur 25% of the expenses for the Scheme. The States' share shall not be met out of funds available under SDMF.

Accounts and Audit

a. The state NDMF account should distinctly show the source of receipt in the fund's name
   - Central share of NDMF
   - The states' share of NDMF
   - Returns on investment
   - Redemption of investment
   - Contribution from reconstruction bond/CSR/implementing partners/community, etc., if any
   - Panel Interest (at bank rate or overdraft rate as the case may be)

b. The actual expenditure out of NDMF should be booked under respective Minor Heads within Major Head 2245

c. The detailed accounts of funds and investment thereof shall be maintained by the Account General in charge of Accounts of the States

d. The account of NDMF shall be audited annually by Comptroller & Auditor General. The State Government shall furnish a copy of the audit report of CAG to the Ministry of Finance and Ministry of Home Affairs

The States/institutes will ensure that the accounts are audited by a CAG / Chartered Accountant selected from a panel approved by the CAG. This account will be supported by a statement of reconciliation from the competent authority.

Based on the scale and nature of the projects, all the projects are taken up for financial and social audits as decided by the Disaster Management Authority

- **Financial Audits** – A financial audit of the funds received and expenditures made will be carried out by the Comptroller and Auditor-General (CAG) of India
- **Technical Audit-** the Disaster Management Authorities identify technical experts to conduct technical audits of all mitigation projects. The authority will decide the number of required audits as per the size and complexity of the projects. The mid-term reviews and projects-end evaluation should be undertaken by experts included in the roster for this purpose
- **Social Audit-** Since most of the mitigation measures require community participation during its process, the social audit will be conducted during the project cycle to review how the project has sought to involve the people at risk and deliver the results to communities, as prescribed by the authority.

Project Preparation, Appraisal, Approval, Monitoring and Implementation Mechanism

- **Project Preparation**

The implementing partner or agency is responsible for the project preparation, identification of the type of intervention, that needs to be carried out, and the pre-feasibility study for the project, which can be both structural and non-structural. The mitigation project may be local community-based interventions that reduce the risk and promote environment-friendly settlement and livelihood practices.

The three procedures that mitigation initiatives pass through during the project preparation phases include Project identification, a project feasibility check, and preparation of a detailed project proposal

a. **Project identification:** A landslide mitigation project may be identified based on landslide risk and their impacts. It should cover the characteristics of the area's landslide proneness, evaluate the risk magnitude, analyze the landslide impacts, and recommend mitigation solutions. A mitigation project can be proposed based on a rationale for mitigation investment based on expected impacts and a cost-benefit analysis. Project proposal needs to be prepared in the template prescribed for the pre-feasibility check (as prescribed in Guideline for NDMF)
b. **Pre-feasibility check:** The pre-feasibility check would be conducted to understand the relevance of the project, its financial viability and technical feasibility. It will be done by a mechanism established by NDMA/SDMA**.** The pre-feasibility check would be conducted to understand the relevance of the project, its financial viability and technical feasibility. After the pre-feasibility check, NDMA/SDMA endorses or declines the proposal. If the NDMA/SDMA endorses the proposal, it leads to the following stages of preparing the Detailed Project Report (DPR). The NDMA/SDMA may also recommend for appropriate revision. A pre-feasibility assessment is not required for projects under Rs 1 crore. Within 30 days of receiving the proposal, the NDMA/SDMA will undertake a pre-feasibility review and notify the implementing partner of its decision. Projects with a budget of less than Rs 1 crore are only required to submit a concept note and do not require a pre-feasibility study. The concept note will describe the essential details of the mitigation project.A detailed project report will be generated after the NDMA/SDMA has approved the concept note.
c. **Preparation of Detailed Project Report:** After the endorsement at the pre-feasibility check, the implementing partner is required to submit the DPR in prescribed format (as prescribed in Guideline for NDMF). It covers all the technical and financial components of the proposed project that are prepared with due diligence within the prescribed time limit. The DPR lays the project goals, activities, cost estimates, and intended impacts in adequate detail.
   The formulation of DPR would require several steps
   - A risk assessment of the landslide, risk exposure and accompanying vulnerabilities
   - Analysis of the context- socio-economic, governance/regulatory and environmental
   - Analysis of the stakeholder's capacities- technical, organizational, and financial
   - Activities planned under the project and the outputs

- Cost-benefit analyses
- Budget for the project activities
- Implementation plan and the timeline for the completion of the project
- Reporting and monitoring arrangement

- **Project Appraisal**

The DPRs of the mitigation project appraise and review all the technical, financial and social aspects of the project. The appraisal consists of the scope and scale of the project, eligibility of the Implementing Partners, appropriate mitigation measures, cost-effectiveness, expected results, implementation arrangement, community participation and social inclusion and monitoring arrangements. The appraisal provides implementing partner an opportunity to review the project design in detail and resolve any outstanding question. NDMA/SDMA may follow an internal mechanism to process the appraisal of the project. This Technical Advisory Committee (TAC) and Project Appraisal Committee (PAC) will be constituted at the NDMA and SDMA levels. In any case, before sending any proposal to NDMA, the proposal should be appraised by the States from both technical and administrative aspects by their appraisal committee and it should have approval of State Executive Committee (SEC), as mentioned in Guideline issued by MHA.

Technical Appraisal Committee (TAC)

TAC is set up to appraise projects from the technical and social point of view, to give its recommendation to the authority, to conduct a technical review of projects, and recommend improvement. The TAC will consist of authority officers and technical experts from landslide risk reduction and other relevant sectors. TAC will also give expert technical advice on the mitigation strategy and action plan to reduce disaster risk relating to the identified hazard. If the TAC is unsatisfied with the project design, it may suggest that the project be rejected. If the TAC does not recommend the proposal, the NDMA/SDMA may refer it to the implementing partner for necessary modification. They also conduct technical reviews of projects sanctioned from mitigation funds and give recommendations for future improvement.

All SDMA will constitute the Technical Appraisal Committee (TAC) with a Technical Member of SDMA to give the programme's overall technical guidance at the state level. The TAC will consist of technical experts of the authority (as may be decided by the authority) and one Geologist, one Soil Conservation Officer, one Geographer and one Civil Engineer essentially.

Project Appraisal Committee (PAC)

After the TAC has completed its technical evaluation, the Project Appraisal Committee (PAC) will appraise the project from an administrative and financial standpoint. The PAC examines whether the project follows government guidelines and instructions. PAC constitutes officers of NDMA/SDMA, line Ministers/departments, and disaster management experts with experience if disaster risk reduction if required. All proposals related to the project, including financial outlay related to the project, will be examined by this committee. The monitoring periodic reviewand evaluation of all the schemes and matters, including financial outlay, modification of the ongoing projects.

Within one months of the DPR's submission, the TAC at the NDMA/SDMA will complete the evaluation and appraisal procedure. If requested by SDMA/ Implementing Partners, NDMA may give technical or other help in evaluating any state-specific mitigation initiative.

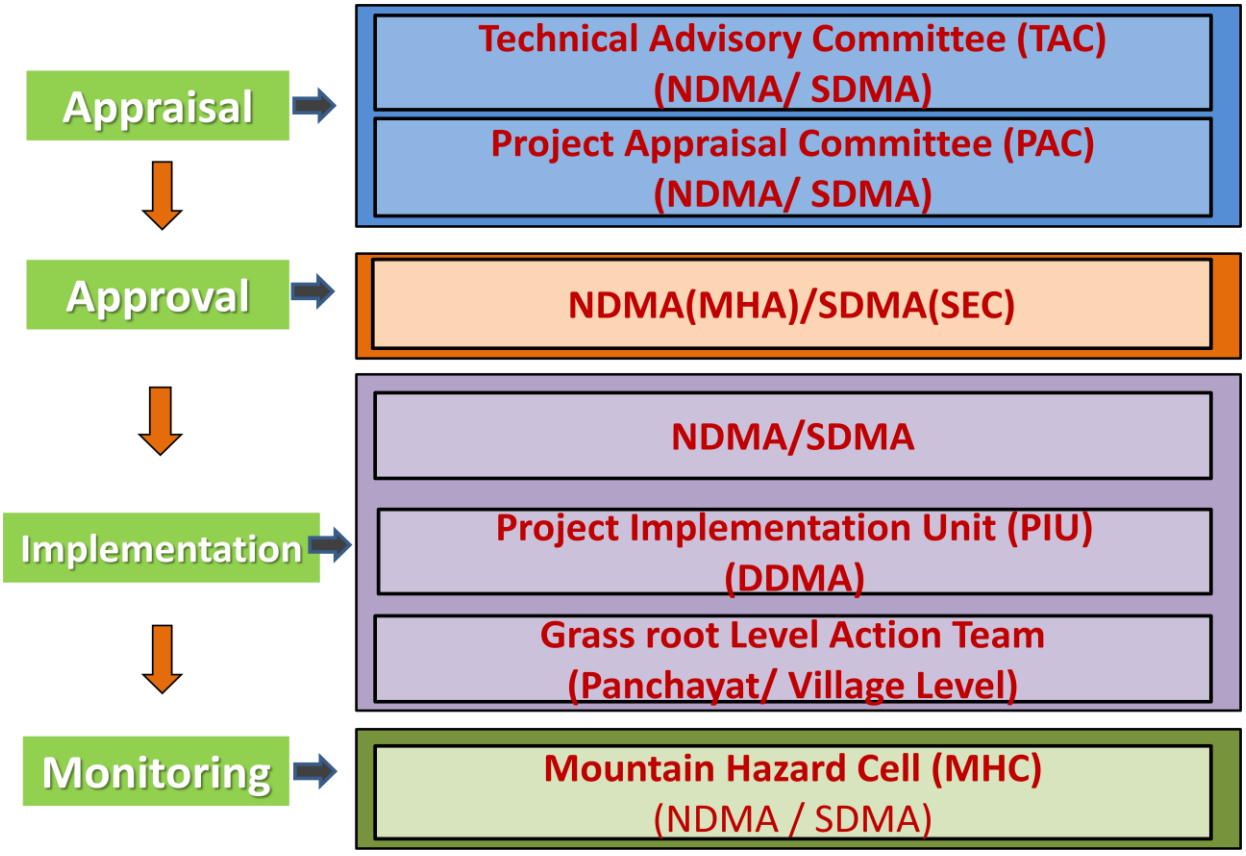


Figure 7: Project Appraisal, Approval, Implementation and Monitoring Mechanism

- **Project Approval**

After approval by HLC on the programme as a whole, States will prepare proposal and submit each of them to NDMA for appraisal. After technical and administrative appraisal of the each individual project at NDMA, States will implement it and States will be Approval Authority for various stages of implementation.

- **Project monitoring**

The monitoring and evaluation of the project involve an overall governance mechanism to coordinate programme activities. This will help to measure the progress of the project towards achieving expected outcomes.

All the mitigation projects may be conducted with a periodic review of the activities. This involves three types, i.e. midterm review, annual review, and project-end evaluation, conducted through external experts to get an objective picture of the project performance. The results of the mid-term review are used for improving the project results. A mid-term review will normally be conducted halfway through the implementation of the programme, which covers all the targets mentioned, including output and outcome. The mid-term review should coincide with the annual review. The annual review is focused on the indicators and targets specified in annual implementation plans. Project-end evaluation involves a comprehensive analysis of progress and performance for the whole period of the programme. Regular progress and performance can be monitored and evaluated through programme outputs and outcomes.

In addition, the implementing partner reports the project results is evaluated externally for their adherence to the project design and the outcome. All the review and evaluation reports will be submitted through the mitigation portal.

- **Project Implementation**

For monitoring and implementation of the programme, four tier institutional structures will be constituted at the National, State, District and Local level, respectively. A **Time Frame of National Programme (Phase-I)has been given at ANNEXURE – D. A component-wise andactivities TimeFrame (Phase-I) has been given at ANNEXURE – E.**

a. <u>National Level</u>

<u>Knowledge Management network:</u>

NDMA will create extra-verticals for inter-agency coordination and collaboration forknowledge sharing amongst stakeholders through a common platform.

MHC at NDMA, with assistance of States, will work to bring together indigenous knowledge, innovations made within the country for use in landslide and GLOF Risk mitigation. It will strive for international collaboration and create awareness among states about global best practices. Under this activity, resource persons/organizations available in the domain will be identified for specified services. NDMA will also create a GIS platform for DRR related applications for States.

At the statelevel, an institution with expertise in dealing with landslides and mountain hazards should be identified to facilitate the technical and scientific inputs for implementing the programme.This statelevel technical institute can interact with expert institutions such as GSI on various landslide research and knowledge-sharing activities.Strengthening the institutional capacity of higher education institutions located in mountainous areas of landslide risk reduction is vital for facilitating landslide knowledge management at the regional level. Establishing a landslide risk reduction centre or similar set-up in those identified institutions can be an ideal platform for facilitating knowledge creation and research and development activities. MHC may play an important role in creating a nationallevel centre and its integration with other technical institutions at the Statelevel. This centre may focus on strengthening qualitative capacities in landslide mitigation by developing a database of local landslide events, disaster information, experience sharing, and

knowledge transfer to the local community.This can also act as liaison support between various research and development institutions.

Role of Geological Survey of India (GSI):

Being the nodal agency for landslide disaster and a premere organization in the country under the Ministry of Mines, GSI will have a major role of providing technical assistance for Landslide risk mitigation. States will carry out hazard risk mapping, geotechnical analysis, and mitigation planning in consultation with GSI, whenever required. At the same time,it is necessary to build capacity of other agencies/institutes/universities, which are working in this area, for similar kind of activities and it is necessary to utilize their knowledge base for disaster risk reduction. Engaging them will also expedite the programme. Hence, States may decide and appoint implementing agencies, including GSI, for relevant activities. However, GSI may mentor all such other agencies, for their relevant activities.

GSI and Ministry of Mines are expected to provide necessary technical assistance to all these States. GSI's support for preparing a regional and State level early warning system will also benefit. Other than this, States may also consult GSI for sensor-based early warning system at local level, wherever required.

b. State Level

It is the responsibility of the State/UT disaster management authorities to identify implementation partner agencies/institutions in consultation with NDMA. Other than the central and state departments/Institutes/Universities, the implementing partner may involve the Non-Governmental Organisation (NGO) /Civil Society Organisation (CSO) having clearance of FCRA working in the areas of disaster management in the implementation of the mitigation project.

The implementation partner may sign an agreement with the Disaster Management Authority and undertakes to implement the project per the approved Implementation plan in the DPR. A detailed project agreement may be drawn up specifically for the mitigation project. It also submits an implementation plan, which lays down the time frame for the completion of all the projects activities. The project implementation must adhere to the period mentioned in the plan.

States may form a Mountain Hazard Cell (MHC) under SDMA in same line as described it for NDMA above. It will comprise of manpower engaged for mitigation projects funded by mitigation fund as mentioned in the guideline issued by MHA. State MHC will be responsible for the overall state-level planning and monitoring of this programme. It should have sufficient human resources with adequate technical capacity to manage the components of this programme.

The State MHC also coordinate site visit / inspection, monitoring, periodic-term evaluation and mid-term course correction. The site visits/ inception may be conducted to assess physical progress and quality of work implemented at the respective.

State MHC will supervise and monitor the approved projects during implementation and will be responsible for submitting completion certificates as well as required reports, including maintaining an updated database containing information about all projects implemented with the

assistance from NDMF.Mitigation activity may be done only after proper risk identification. Otherwise, all four components may be implemented simultaneously.

c. District Level

A district-level Project Implementation Unit (PIU) may be constituted under DDMA for all selected project districts under supervision of concerned SDMA / State Disaster Management Department. This PIU will facilitate the successful implementation at the district level. Suitable officials from district administration may be assigned with the charge of this PIU.

d. Local Level

A participatory approach shall be followed for efficient and scientific implementation at the local level. For this, **grassroots action team** will be constituted at the local level of the project areas to ensure community participation through community volunteers with incentives as per work basis through running programme of Govt. of India i.e., MGNERGA. The team will include the Secretary of the concerned Local Government, the people's representative of the concerned ward and an individual of repute nominated by the President/Chairperson/Mayor of the Local Government. The NGOs having the capacity and prior experience in the landslide and the sustainable management of the mountain environment may be selected to facilitate the project implementation at the local level. The team of the support organizations will be given adequate capacity support and training to facilitate and implement the project at the grassroots level.

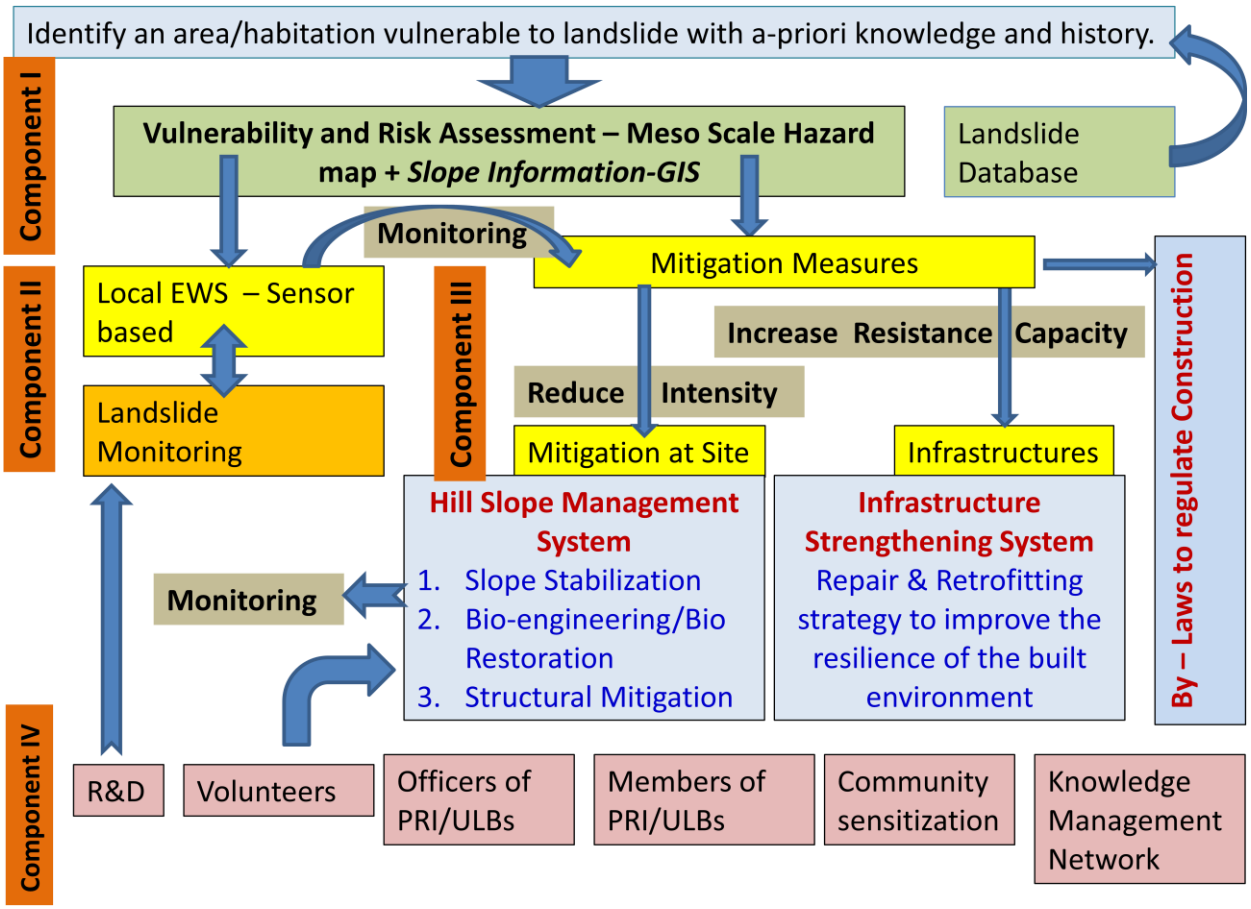


Figure 8:Inter-relation among four components of the programme

- **Convergence among Projects**

This programme may also be integrated with the ongoing skill and livelihood initiatives of the Government of India like the Mahatma GandhiNational Rural Employment Guarantee Scheme (MGNREGS), National Rural Livelihood Mission (NRLM), and National Urban Livelihood Mission (NULM)Compensatory Afforestation Fund Management and Planning Authority (CAMPA), to reduce landslide risk and its mitigation. States may converge mitigation activities under this programme with other Central Government sponsored programme or State run programme. For example:

a. Community based mitigation activities for slope stabilization, bio restoration may be converged with MGNREGA, CAMPA activities.
b. Structural mitigation activities may be converged with road development programme like PMGSY, NHAI/State highway project.
c. Creation of volunteers may be converged with Aapda Mitra Scheme, if exists already.

- **Sustainability of the Programme**

The basic purpose of NDMF is to promote investment for mitigation rather than recovery and reconstruction. NLRMP will start mainstreaming landslide mitigation in developmental activities. Though it is proposed to be implemented with a corpus of 1000 cr in first phase, this amount is insufficient to mitigate all landslide prone area (even though only area under human movement is considered) within the country. Hence, it has to be continued until until landslide resilience is achieved fully. Based on learning and outcomes of first phase NDMA will submit proposals for the subsequent phases covering remaining areas/states affected. Subsequent phases may be funded from NDMF, granted by subsequent Finance Commissions or otherwise, having similar arrangements of funding.Thus, its financial sustainability may be ensured.

During implementation of first phase of NLRMP NDMA and States/UTs will set up a Mountain Hazard Cell comprising subject experts. SDMAs/DDMAs also will develop an institutional arrangement for planning, implementation, and monitoring of mitigation activities, as mentioned earlier. These arrangements may be continued for subsequent phases. Thus, programmes' institutional sustainability may be ensured.

There will be sufficient scope to build capacity among manpower engaged for implementation of first phase of NLRMP. Various organizations/institutes at national/state level will get exposure to mitigation activities and assistance from international collaboration. Accordingly, a trained manpower will get ready for more intensive subsequent phases of NLRMP. Thus, programmes' technical sustainability will be ensured.

Annexure-A

District-wise Landslide susceptibility conditions in hilly areas in India covered under the NLSM programme extracted from the available database (Source: GSI)

States	District	Target (sq.km.)	Low (sq.km.)	Low %	Moderate (sq. km.)	Moderate %	High (sq. km.)	High %
Kerala	Ernakulum	115.7	64.0	55.3	36.4	31.5	15.3	13.2
	Idukki	5963.7	2440.4	40.9	2499.7	41.9	1023.2	17.2
	Kannur	1384.8	839.6	60.6	415.0	30.0	130.0	9.4
	Kasargod	1193.4	708.9	59.4	401.4	33.6	83.0	7.0
	Kollam	1137.2	508.7	44.7	504.6	44.4	123.4	10.9
	Kottayam	477.6	267.7	56.1	143.2	30.0	66.6	13.9
	Kozhikode	861.3	316.9	36.8	359.8	41.8	184.4	21.4
	Malappuram	974.6	464.0	47.6	341.7	35.1	168.7	17.3
	Palakkad	1890.0	1034.0	54.7	583.1	30.9	272.5	14.4
	Panthanamthitta	1487.2	839.5	56.4	480.2	32.3	167.5	11.3
	Thiruvananthapuram	681.8	260.7	38.2	351.9	51.6	68.9	10.1
	Thrissur	998.6	548.3	54.9	320.3	32.1	130.0	13.0
	Wayanad	2134.9	1647.1	77.2	405.2	19.0	82.5	3.9
	Total	**19300.6**	**9940.0**	**51.5**	**6842.3**	**35.5**	**2516.0**	**13.0**
Karnataka & Goa	Belgaum	1331.4	1203.4	90.4	102.1	7.7	25.7	1.9
	Chikmagalur	4626.2	3496.8	75.6	939.4	20.3	189.5	4.1
	Dakshin Kannada	4316.8	3507.3	81.2	651.7	15.1	148.2	3.4
	Hassan	1425.2	1186.5	83.3	184.8	13.0	52.9	3.7
	Kodagu	3991.0	3293.4	82.5	408.5	10.2	282.1	7.1
	Mysore	31.3	24.8	79.3	0.4	1.2	0.2	0.5
	North Goa	1707.2	1286.0	75.3	378.8	22.2	42.2	2.5
	Shimoga	4766.5	4036.5	84.7	677.3	14.2	52.3	1.1
	South Goa	1838.9	1215.8	66.1	542.1	29.5	81.0	4.4
	Udupi	2494.4	2028.7	81.3	367.8	14.7	97.8	3.9
	Uttar Kannada	8339.9	6874.0	82.4	1156.0	13.9	309.2	3.7
	Total	**34868.8**	**28153.3**	**80.7**	**5408.9**	**15.5**	**1280.8**	**3.7**
Tamil Nadu	Coimbatore	1400.5	1067.2	76.2	242.3	17.3	90.8	6.5
	Dindigul	1807.3	1271.3	70.3	502.6	27.8	33.3	1.8
	Erode	73.5	52.4	71.3	18.2	24.7	2.9	3.9
	Kanyakumari	691.8	533.0	77.1	64.1	9.3	94.4	13.6
	Madurai	388.9	310.7	79.9	58.9	15.1	19.2	4.9
	The Nilgiris	2574.0	1862.4	72.4	466.3	18.1	245.4	9.5
	Theni	1445.1	1047.7	72.5	329.4	22.8	67.6	4.7
	Tirunelveli	1364.0	1074.8	78.8	193.2	14.2	95.9	7.0
	Tiruppur	552.1	456.7	82.7	72.9	13.2	22.6	4.1

	Virudhnagar	251.5	200.7	79.8	37.8	15.0	12.8	5.1
	Total	**10548.8**	**7877.0**	**74.7**	**1985.7**	**18.8**	**684.8**	**6.5**
Andhra Pradesh	Vishakhapatnam	1107.4	531.9	48.0	505.9	45.7	69.4	6.3
	Vizianagaram	6.3	1.6	24.9	4.4	70.5	0.3	4.7
	Total	**1113.7**	**533.5**	**47.9**	**510.4**	**45.8**	**69.7**	**6.3**
Odisha	Koraput	9.9	3.2	32.7	5.7	57.9	0.9	9.5
Maharashtra	Ahmednagar	545.6	335.4	61.5	184.8	33.9	24.7	4.5
	Kolhapur	4033.1	2697.5	66.9	1296.3	32.1	34.6	0.9
	Nashik	23.4	10.5	44.8	10.8	46.3	2.1	8.9
	Pune	4667.5	2920.6	62.6	1468.5	31.5	275.6	5.9
	Raigarh	6085.2	3767.4	61.9	2033.5	33.4	258.9	4.3
	Ratnagiri	7761.1	4038.1	52.0	3404.4	43.9	313.4	4.0
	Sangli	345.0	212.2	61.5	126.9	36.8	5.6	1.6
	Satara	3277.5	2199.5	67.1	919.1	28.0	155.3	4.7
	Sindhudurg	2323.3	1101.0	47.4	1088.2	46.8	133.3	5.7
	Thane	129.2	46.9	36.3	62.6	48.4	12.1	9.3
	Total	**29190.8**	**17329.0**	**59.4**	**10595.1**	**36.3**	**1215.4**	**4.2**
Jammu & Kashmir (UT)	Anantnag	2671.5	1905.5	71.3	579.3	21.7	186.8	7.0
	Doda	1832.9	947.0	51.7	541.1	29.5	344.9	18.8
	Jammu	769.2	743.4	96.6	24.4	3.2	1.5	0.2
	Kathua	2054.7	1551.5	75.5	272.3	13.3	230.9	11.2
	Kishtwar	8911.2	4117.8	46.2	3089.6	34.7	1703.1	19.1
	Kulgam	961.4	580.6	60.4	318.3	33.1	62.5	6.5
	Ramban	1119.3	429.0	38.3	455.0	40.7	235.3	21.0
	Reasi	1771.9	929.7	52.5	562.1	31.7	280.1	15.8
	Samba	615.0	582.8	94.8	30.8	5.0	1.4	0.2
	Shopian	230.7	212.7	92.2	14.9	6.4	3.1	1.3
	Udhampur	2414.1	1620.3	67.1	529.4	21.9	264.4	11.0
	Bandipore	834.7	828.3	99.2	6.2	0.7	0.1	0.0
	Baramulla	1000.7	994.4	99.4	6.1	0.6	0.4	0.0
	Budgam	731.1	728.9	99.7	2.2	0.3	0.0	0.0
	Ganderbal	773.8	629.6	81.4	89.1	11.5	55.1	7.1
	Kupwara	840.5	771.7	91.8	67.3	8.0	1.4	0.2
	Pulwama	275.9	264.0	95.7	11.2	4.1	0.7	0.3
	Srinagar	804.8	740.1	92.0	60.1	7.5	4.6	0.6
	Data not available	276.6	267.9	96.8	8.7	3.1	0.1	0.0
	Total	**28889.9**	**18845.2**	**65.2**	**6667.9**	**23.1**	**3376.3**	**11.7**
Ladakh (UT)	Kargil	10628.6	4389.9	41.3	3747.7	35.3	2491.1	23.4
	Leh	29436.1	12274.5	41.7	11215.5	38.1	5945.6	20.2
	Total	**40064.7**	**16664.4**	**41.6**	**14963.3**	**37.3**	**8436.7**	**21.1**
Punjab	Gurdaspur	14.7	6.5	44.3	4.0	27.2	4.2	28.6
	Total	**14.7**	**6.5**	**44.3**	**4.0**	**27.2**	**4.2**	**28.6**
Himachal Pradesh	Bilaspur	1156.7	868.8	75.1	199.8	17.3	88.1	7.6
	Chamba	12509.3	2759.6	22.1	4387.4	35.1	5361.9	42.9

	Hamirpur	1127.6	761.7	67.6	260.2	23.1	105.7	9.4
	Kangra	2729.3	1395.7	51.1	736.5	27.0	597.1	21.9
	Kinnaur	3905.5	1443.3	37.0	902.7	23.1	1559.6	39.9
	Kullu	2492.2	858.9	34.5	1027.6	41.2	605.7	24.3
	Lahul and Spiti	3956.0	2352.1	59.5	720.6	18.2	883.1	22.3
	Mandi	3930.2	2313.2	58.9	1190.2	30.3	426.7	10.9
	Shimla	4975.1	2805.5	56.4	1425.7	28.7	744.0	15.0
	Sirmaur	2697.5	1698.8	63.0	534.4	19.8	464.4	17.2
	Solan	1657.2	938.1	56.6	544.5	32.9	174.6	10.5
	Una	956.9	693.1	72.4	184.8	19.3	79.1	8.3
	Total	**42093.5**	**18888.7**	**44.9**	**12114.5**	**28.8**	**11090.0**	**26.3**
Uttarakhand	Almora	3103.4	1744.1	56.2	787.1	25.4	572.2	18.4
	Bageshwar	2069.8	783.2	37.8	713.1	34.5	573.5	27.7
	Chamoli	5391.8	1920.7	35.6	1859.7	34.5	1611.4	29.9
	Champawat	1633.9	843.7	51.6	545.2	33.4	244.9	15.0
	Dehradun	2064.4	1145.0	55.5	554.2	26.8	365.4	17.7
	PauriGarhwal	5312.6	2522.9	47.5	1917.8	36.1	872.2	16.4
	Haridwar	292.7	108.7	37.1	143.4	49.0	40.7	13.9
	Nainital	2741.3	1432.9	52.3	748.0	27.3	560.2	20.4
	Pithoragarh	5309.4	2060.6	38.8	1784.1	33.6	1457.7	27.5
	Rudraprayag	1552.3	773.3	49.8	461.1	29.7	317.8	20.5
	TehriGarhwal	3612.1	1927.7	53.4	1147.0	31.8	537.4	14.9
	Udham Singh Nagar	8.4	8.3	99.0	0.1	0.7	0.0	0.0
	Uttarkashi	5916.7	2676.7	45.2	1805.6	30.5	1433.3	24.2
	Total	**39008.8**	**17947.8**	**46.0**	**12466.3**	**32.0**	**8586.6**	**22.0**
Assam	Bongaigaon	465.1	428.5	92.1	29.4	6.3	7.0	1.5
	Cachar	2548.2	2287.1	89.8	205.8	8.1	54.4	2.1
	Chirang	53.5	52.2	97.6	0.8	1.5	0.1	0.2
	Darrang	150.8	148.9	98.7	1.0	0.7	0.5	0.3
	Dhubri (old)	144.1	138.9	96.3	4.4	3.1	0.7	0.5
	Goalpara	344.6	318.9	92.6	22.0	6.4	2.4	0.7
	Golaghat	311.4	298.6	95.9	11.1	3.6	1.0	0.3
	Hailakandi	862.7	708.6	82.1	145.4	16.9	8.5	1.0
	Jorhat	358.9	349.0	97.2	9.7	2.7	0.2	0.1
	Kamrup Rural	1015.5	968.9	95.4	41.4	4.1	4.4	0.4
	Kamrup Metropolitan	1086.0	930.0	85.6	108.0	9.9	47.6	4.4
	KarbiAnglong (old)	9749.7	8601.6	88.2	985.0	10.1	162.1	1.7
	Karimganj	181.2	159.1	87.8	20.4	11.3	1.0	0.6
	Kokrajhar	139.1	132.0	94.9	6.1	4.4	0.8	0.5
	Morigaon	166.0	157.1	94.7	7.7	4.6	0.8	0.5
	Nagaon (old)	1039.8	974.0	93.7	55.0	5.3	9.7	0.9
	Dima Hasao	5051.0	3867.1	76.6	984.3	19.5	199.5	3.9
	Sivasagar (old)	114.7	109.1	95.1	4.6	4.0	0.6	0.5
	Sonitpur (old)	361.2	341.8	94.6	16.5	4.6	1.5	0.4

	Total	**24143.6**	**20971.3**	**86.9**	**2658.4**	**11.0**	**502.7**	**2.1**
Meghalaya	East Garo Hills	2888.7	2603.4	90.1	260.9	9.0	24.1	0.8
	Jaintia Hills (old)	3919.2	3603.4	91.9	268.0	6.8	47.3	1.2
	East Khasi Hills (old)	2885.8	2248.7	77.9	559.1	19.4	77.8	2.7
	Ri-Bhoi	2490.6	2294.3	92.1	171.3	6.9	25.1	1.0
	South Garo Hills (old)	1966.0	1680.0	85.5	266.3	13.5	19.8	1.0
	West Garo Hills	3088.3	2976.0	96.4	109.6	3.5	2.0	0.1
	West Khasi Hills	5362.5	4898.3	91.3	413.7	7.7	50.5	0.9
	Total	**22601.1**	**20304.0**	**89.8**	**2048.9**	**9.1**	**246.6**	**1.1**
Manipur	Bishnupur	500.4	493.9	98.7	5.4	1.1	1.2	0.2
	Chandel (old)	3323.7	1656.0	49.8	1078.4	32.4	589.2	17.7
	Churachandpur (old)	4759.0	2711.4	57.0	1263.8	26.6	783.0	16.5
	East Imphal (old)	514.6	446.5	86.8	46.6	9.1	21.4	4.2
	West Imphal	520.1	510.1	98.1	6.0	1.2	3.9	0.8
	Senapati (old)	3632.1	1780.3	49.0	1165.1	32.1	686.8	18.9
	Tamenglong (old)	4359.6	2166.3	49.7	1292.4	29.6	900.8	20.7
	Thoubal (old)	744.1	678.4	91.2	56.1	7.5	9.6	1.3
	Ukhrul (old)	4659.7	1903.7	40.9	1600.1	34.3	1155.9	24.8
	Jiribam	236.7	185.3	0.0	37.2	0.0	14.3	1.1
	Total	**23250.1**	**12532.0**	**53.9**	**6551.0**	**28.2**	**4166.1**	**17.9**
Nagaland	Dimapur	840.4	666.5	79.3	128.1	15.2	45.9	5.5
	Kiphire	1203.0	400.0	33.2	451.0	37.5	352.1	29.3
	Kohima (old)	1541.2	604.8	39.2	614.8	39.9	321.7	20.9
	Longleng	591.0	297.2	50.3	177.7	30.1	116.1	19.6
	Mokokchung	1678.5	1076.6	64.1	431.5	25.7	170.4	10.2
	Mon	1888.9	1052.8	55.7	576.5	30.5	259.3	13.7
	Peren	1811.8	1135.2	62.7	443.7	24.5	233.0	12.9
	Phek	2137.6	652.5	30.5	810.5	37.9	674.5	31.6
	Tuensang (old)	2588.0	743.6	28.7	960.7	37.1	883.7	34.1
	Wokha	1696.1	1100.0	64.9	420.6	24.8	175.5	10.3
	Zunheboto	1317.5	507.0	38.5	443.7	33.7	366.8	27.8
	Total	**17294.1**	**8236.1**	**47.6**	**5458.8**	**31.6**	**3599.0**	**20.8**
Mizoram	Aizawl (old)	3866.9	2146.7	55.5	920.5	23.8	798.5	20.6
	Champhai (old)	3480.5	1793.9	51.5	977.7	28.1	706.7	20.3
	Kolasib	1394.2	1103.1	79.1	173.5	12.4	117.5	8.4
	Lawangtlai	2068.4	1474.1	71.3	397.7	19.2	195.5	9.4
	Lunglei (old)	4677.6	2650.8	56.7	1410.1	30.1	615.6	13.2
	Mamit	3136.3	2260.5	72.1	497.1	15.8	377.9	12.0
	Saiha	2047.0	750.1	36.6	779.8	38.1	515.7	25.2
	Serchhip	1194.1	641.9	53.8	347.9	29.1	204.2	17.1
	Total	**21864.9**	**12821.1**	**58.6**	**5504.4**	**25.2**	**3531.5**	**16.2**
Tripura	Dhalai	572.9	546.3	95.4	19.6	3.4	5.8	1.0
	North Tripura (old)	793.7	719.0	90.6	47.4	6.0	25.9	3.3

	Total	**1366.6**	**1265.3**	**92.6**	**66.9**	**4.9**	**31.6**	**2.3**
Sikkim	East	952.9	353.6	37.1	494.6	51.9	111.3	11.7
	North	2217.6	965.7	43.5	760.2	34.3	487.8	22.0
	South	723.9	312.7	43.2	305.2	42.2	104.4	14.4
	West	1085.0	358.0	33.0	541.1	49.9	190.3	17.5
	Total	**4979.3**	**1990.0**	**40.0**	**2101.1**	**42.2**	**893.8**	**18.0**
West Bengal	Darjeeling	1286.4	486.6	37.8	600.4	46.7	189.4	14.7
	Jalpaiguri	578.5	364.2	63.0	136.8	23.6	77.5	13.4
	Kalimpong	1114.9	399.7	35.9	466.8	41.9	247.7	22.2
	Total	**2979.9**	**1250.5**	**42.0**	**1204.0**	**40.4**	**514.6**	**17.3**

Annexure-B

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Annexure – C

Pilot Projects implemented by NDMA

Sl no	Site name	Stretch/area (km/sq km)	DPR prepared by	Work executed by	Time taken to complete the work * (year of completion)	Expenditure incurred (Rs in cr)
1	Generation of Meso Level 1:10,000 Scale Maps & Landslide Inventory for Tapovan-Vyasi Corridor of Haridwar-Badrinath NH-58	Study area covers a stretch of 27.3 km from Tapovan-Vyasi road stretch	Base data provided by Survey of India (SoI) Geo-technical Investigation of samples collected by GSI with the support of IIT R Project coordinated by RSAC UP	RSAC UP & IIT R	3 Years (March 2022)	0.29
2	Development of Low-Cost Landslide Monitoring Solutions and Early Warning System	NA	Project conceptualized by IIT Mandi	IIT Mandi	2 Years (March 2021)	0.278
3	LRMS - Kohima-Thizama Road below Nagaland Legislative Assembly, Kohima, **Nagaland**	195m x 165m Approx.	NSDMA	NSDMA	3 years (Aug 2022) **Rs. /- (Cr.)**	**14.963**
4	LRMS - Restoration of	76000sqm	PwD, Government of Mizoram	PwD,	3 years (Sep	**20.8645**

	National Highway-54 and Mitigation of Land Sinking Area at Hunthar Veng, Aizawl, **Mizoram**	(approx)	and DM&R, Mizoram	Government of Mizoram and DM&R, Mizoram	2022)	
5	LRMS - Mangan, North **Sikkim**	20000 sqm (Approx.)	PwD, Government of Sikkim and SSDMA, Sikkim	PwD, Government of Sikkim and SSDMA, Sikkim	3 years (Mar 23)	**14.939**
6	LRMS - Karnprayag-Gwaldam-Jhuljivirajya Motor Marg No. 11 (km 166)-Hardiyanala Uttarakhand	14000 Sqm (Approx.)	PwD, Government of UK and UKSDMA	PwD, Government of UK and UKSDMA	3 years (Mar 2023)	**14.3507**
7	LRMS - Kempty-Chadogi Bye-Pass Road, at CH. 1.0 KM, **Uttarakhnd**	31500 sqm (Approx.)	PwD, Government of UK and UKSDMA	PwD, Government of UK and UKSDMA	3 years (Mar 2023)	**14.3507**

*Inclusive of COVID-19 delay of approx 1-1.5 Years

ANNEXURE – D: Time Frame of National Programme (Phase-I)

Activity	First Year					Second Year					
	Q1	Q2	Q3	Q4		Q1	Q2	Q3	Q4		
Preparation of project proposals &concept note											
Project Feasibility Study											
Project cost estimate											
Work break down structure											
Project Appraisal											
Project Approval											
Identification of technical institute (if applicable)											
Procurement of goods and services (if applicable)											
Activity tracking (site inspection; if required)											
Budget tracking											
Annul progress report											
Monitoring and Evaluation											
Project closure/completion report with submission of Deliverables											

ANNEXURE – E: Component-wise Activities Time Frame (Phase-I)

Activities	First Year				Second Year			
	Q 1	Q 2	Q 3	Q 4	Q 1	Q 2	Q 3	Q 4
Creation of Landslide Inventory database								
Template/format to record landslide catalogue								
Develop a database on the severity, size and volume of debris generated and economic loss of particular landslide								
Compilation and generation of a landslide database								
Landslide Hazard Zonation maps with low, medium, high hazard zonation								
Develop a GIS-based slope information system								
Land Use regulation								
Integrating slope information with infrastructure development planning								
Evaluate the status of the stability of the slopes.								
Updation of the slope details at a regular interval								
Geo Investigation of vulnerable existing infrastructure activities								
Map all critical infrastructures in the high-risk areas								
Retrofitting all the sub-standard construction								
Regular monitoring of the human activities in high-risk areas								
Develop mesoscale maps in high-risk areas								
Mapping the causative factors for the occurrence of landslide								
Identify various elements exposed to landslide risk								
Compilation of the data and evaluating the risk scenarios.								
Use of web-based and app-based dissemination tools for the preparation of mesoscale maps								

Use of the latest Science & Technology (S&T) tools to develop monitoring and Early Warning Systems with last-mile connectivity and outreach											
Design a low cost, and simple technology community-centric early warning system											
Install instrumentation-based landslide early warning system for societal use.											
Ensure the last mile connectivity through SMS and Sirens											
Community-based slope stabilization by local interventions											
Drainage management and correction in the mountain slopes											
Construction of diversion waterways, designing drainage systems to run along natural drainage lines											
Enhance adaptive capacity and create awareness in landslide risk management											
Bio restoration initiative for the fragile landscape prone to landslides											
Develop bio-restoration protocol											
Plant indigenous vegetation for slope stabilization											
Strengthening eco-friendly strategies for landslide mitigation											
Stabilizing the high-risk mountain slope											
Strengthen landslide risk aspects in the states, building rules and regulations to improve the resilience of the built environment											
Review existing building rules and regulations of all landslide-prone states											
Incorporate hazard resistant elements in the existing rules and regulations											
Feasibility study to adopt Slope modification regulations of the Aizawl Municipal Corporation in other landslide-prone regions in the country											
Identification and adoption of site-specific structural measures											
Feasibility study of social and environmental acceptability of mitigation project											
Identification of appropriate structural measures											
Implementing site-specific structural measures											

Research and Development (R&D)												
Carry out scientific study on landslide risk												
Conduct seminar/workshops/symposium												
Publication of research articles and scientific reports												
Capacity Building Programmes for state and district level officers												
Sensitize the government officials about the landslide risk under their jurisdiction												
Strengthening the training institutes on landslide risk												
Improve organizational and capability, skills to deal with landslide risk situations												
Recognize the role and responsibilities of different stakeholders.												
Capacity building programme for the Panchayati Raj Institution members in the landslide-prone areas												
Impart training to the targeted participants among the elected members of Panchayat Raj Institutions (Local bodies)												
Conduct site visits in the past landslide locations												
Develop training modules												
Recognize the role and responsibilities of local self-government members in landslide risk reduction												
Enhancing adaptive capacity and creating awareness in landslide risk management												
Strengthen the Community through Sensitization Programme for the landslide risk reduction												
Conduct training programmes in high-risk areas												
Identify non-profit organizations to undertake awareness-building activities.												
An illustrated booklet with information on landslide awareness in local languages.												
Capacitate communities to prevent, mitigate and cope with disasters effectively												

Involvement of local communities, inhabited individuals, youth clubs, NGOs in awareness programmes											
Identification of landslide safe locations in the proximity of the village for the construction of temporary or permanent community centres											
Creation of Knowledge Management centre											
Setting up of knowledge creation centre for Landslide management in the higher educational institutions located in mountain areas											
Constitute a Mountain Hazard Team at the NDMA level											
Enhance the network among various expert institutions in landslide management											
Facilitate research and documentation in landslide management											
Support the state level training institutes in landslide risk reduction training											
Creation of a community village task force for landslide preparedness											
Constitute a village task force in each landslide-prone village											
Sensitize the villagers about the hazard, vulnerability and elements at risk in their respective villages and surroundings											
Regular training sessions for specific skill development.											
Rescue and response to ensure effective and prompt action in the event of a landslide											
Skill Development through Indigenous knowledge and methods											