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1. Introduction

Kerala, with a population of over 33 million, is globally recognized for its commendable achievements with respect to Human Development. In India, Kerala ranks first among Indian states on the Human Development Index, however, Kerala is vulnerable to natural disasters and is categorized as a multi-hazard zone state. Climate Change has aggravated the frequency and magnitude of extreme weather events in the State. The high population density of the state makes it highly vulnerable.

Kerala State Disaster Management Plan 2016 identifies 39 hazards specific to the state. Kerala is also one of the most densely populated states (860 persons per square kilometre). The dynamic components of the plan are updated annually in the month of May prior to the monsoon as Orange Book. Orange Book contains 9 chapters and deals with the annual prognosis of monsoon, sources of authentic alert information, updated hazard assessments, roles and responsibilities, notification of Incident Response Teams upto Taluk, coordination protocols, inter-agency groups, civil defence, financial provisions relevant, allocation of funds for preparedness actions, camp management protocols, Standard Operating Procedures etc. The Orange Book is updated every year after examining the learnings and experiences of the previous year.

Nearly 15% of the state's land area is prone to landslides. The National Landslide Susceptibility Mapping by Geological Survey of India (2022) and the Landslide Susceptibility Mapping done by National Centre for Earth Science Studies (2010) are used for various regulatory functions. Fatal landslides are on the rise in the State. In 2018, 4728 landslides occurred in the State; of this 1760 were shallow slides, 2816 were debris flows and 152 were rockfall (<https://doi.org/10.5194/essd-12-2899-2020>). The State was hit by a series of landslides in 2019 resulting in the loss of 125 lives. On 6 August 2020, 66 people died in Pettimudi, Idukki in the South Indian state of Kerala due to a landslide. On 16th October 2021, in Kanjirappally Taluk of Kottayam district alone about 23 landslide events were reported in villages viz., Koottickal, Edakunnam, Mundakkayam, Erumely North and Koruthodu. Landslide events were also reported from multiple locations in Meenachil Taluk of Kottayam district on the same day. Amongst, Koottickal village was the most affected. The bodies of all the 13 persons reported missing following the landslides in Koottickal have been recovered. Idukki district also reported about 23 landslides in Peerumedu Taluk alone on 16th October 2021. The major landslide occurred at

Mackochi of Kokkayar village of Peerumedu taluk at about 11 am. The devastating landslide caused huge damage and took the lives of 7 people amongst 5 were children.

As a long term landuse change and mitigation measure, the State created a vulnerability linked relocation plan vide GO (Rt) No. 7/2018/DMD dated 21-6-2018 whereby any house identified as in a site susceptible to floods or landslides, the family is offered Rs. 6 lakhs to purchase a minimum of 3 cents of land and Rs. 4 lakhs for constructing a house. The uniqueness of the programme is that the original land may be retained by the family, but the family cannot reside at the site. More than 4000 families across the State accepted the said offer and translocated themselves to safer sites.

1.1. Monsoon Forecast and Preparedness

1. 02-05-2024: Annual monsoon preparedness meeting chaired by Hon'ble Chief Minister
2. 17-05-2024: Annual monsoon preparedness meeting of local self governments were chaired by Chief Secretary and Additional Chief Secretary, Local Self Government Department
3. 27-5-2024: The 1st long range forecast (LRF) by India Meteorological Department (IMD). Monsoon seasonal rainfall will be 106% of the Long Period Average (LPA) with a model error of $\pm 5\%$.
4. 25-5-2024: Dam Rule Curve Complaine Monitoring Committee chaired by the Principal Secretary, Disaster Management
5. 30-5-2027: Based on the LRF, Chief Secretary chaired a meeting of all the departmental heads, district collectors and district joint directors of local self government in which all the stakeholders were assigned specific tasks for better preparedness during the monsoon season.
6. 11-6-2024 to 14-6-2024: Incident Response Team Training for officers of all districts.
7. 12-6-2024: Vide Govt. Ltr. No. DMA1/98/2024-DMD dated 12-6-2024 requested 9 teams of NDRF to be pre-positioned in the State, including at Wayanad. The teams were pre-positioned.
8. 26-7-2024: Minister for Revenue held a review meeting with district collectors to assess the readiness of districts
9. 27-6-2024: The State Executive Committee met on 27-6-2024 and approved the Orange Book for the year 2024 and recommended for approval of State Disaster Management Authority chaired by Chief Minister

10. 01-7-2024: Principal Secretary, Disaster Management & State Relief Commissioner took a review meeting with district collectors to assess readiness of districts
11. 03-07-2024: Chief Minister reviewed the status of debris removal from rivers and streams in the State
12. 04-07-2024: School safety circular in light of monsoon was issued by General Education Department
13. 05-7-2024: Readiness at the district level and that of the armed forces were reviewed by Chief Minister. In the meeting changes brought about to the Orange Book for the year 2024 was presented to all stakeholders and the [Orange Book of 2024](#) was approved as an addendum to the State Disaster Management Plan. The armed forces committed humanitarian aid and disaster response support and process flow for requisitioning various services of armed forces from State EOC was reaffirmed and included in the Orange Book such that turn around time of the HADR support is shorter. This readiness of the State in liaison with the armed forces and NDRF ensured speedy response in Wayanad on 30-7-2024

All districts conducted District Disaster Management Authority meetings to ensure that the decisions of the monsoon preparedness meeting were taken forward for scrupulous implementation by the respective departments.

1.2. Preparedness in Wayanad district

The Local Self Governments of Wayanad district has disaster management plans prepared by them based on a consultative process supported by Kerala Institute of Local Administration and Kerala State Disaster Management Authority. The Meppadi Grama Panchayath which was affected by the landslide also meticulously prepared a disaster management plan (https://dmp.kila.ac.in/maps/Wayanad/1096-Meppadi_GP/Disaster_Management_Plan_Document_2019.pdf). Vide GO (Ms) No. 84/2022/LSGD dated 19-4-2022, the 14th Five Year Plan of Local Self Governments in the State has issued clear guidelines for preparation of annual plans. Section 7.2 of this Guidelines provides for local self governments to create projects for the implementation of priority projects identified in the disaster management plans utilizing the annual development funds available with the Local Self Governments. Wayanad district also has a unique portal for disaster risk reduction initiatives called the DM Suite (<https://www.dmsuite.kerala.gov.in/>). The Suite facilitates the following:

- Rainfall Data Collection – the data source is rainfall measurements by plantations. The data is automatically interpolated to each LSG every day morning by 10 am. The data is collected through a Mobile App.
- Disaster Resource Management
- DM Clubs for Students – the Schools of Wayanad have DM clubs which are funded by the district panchayath
- Trainings for Resilient Constructors

Disaster Respose Forces available in Wayanad		
Sl. No	Force	Number
1	Fire & Rescue Services (3 stations – Kalpetta, Sultan Bathery, Mananthavady)	158
2	Civil Defence Volunteers (attached to Fire and Rescue Services Stations – Kalpatta 50, Sulthan Bathery 20, Mananthavady 40)	110
3	Aapda Mitra Volunteers (attached to Fire and Rescue Services Stations – Kalpatta 70, Sulthan Bathery 89, Mananthavady 41)	200
4	National Disaster Response Force (pre-positioned at Meenangadi town of Wayand in June 2024)	30

The DDMA started its preparedness early in the month of May 2024 to face the monsoon.

The activities are given below:

Sl No	Date	Time	Events	Decisions
1	09-05-2024	11:00 am	Offline-Meeting Drought & Monsoon Preparedness	All nodal departments attended the meeting.
2	26/06/2024	5.00-6.00 am	Monsoon emergency meeting of nodal officers regarding Heavy Rainfall Warnings	Entire Tourist Destination-including Public& Private. Earth Cutting and Quarrying has been banned
3	28/06/2024	11 am-12.30 pm	Monsoon emergency review meeting regarding Heavy Rainfall Warnings	Review Meeting with all nodal Departments regarding the Monsoon Preparedness
4	16/07/2024	1130 am-12.30 pm	Monsoon preparedness meeting	Earth Cutting and Quarrying has been banned. Trekking at 900 Kandi & Edakkal Caves has been stopped until further orders
5	17/07/2024	4.30 pm-5.30 pm	Monsoon emergency meeting with Tahsildars, Geology, Soil, PRD, KSEB, JD-LSGD, DAM Authorities	Vulnerable people should be moved to camps
6	19/07/2024	12.00-	Charge Minister review meeting	Review Meeting with all nodal

		1.00 pm		Departments regarding the Monsoon Preparedness
7	21/07/2024	10.30-11.30 am	Emergency meeting-Tahsildars, Geology Soil, PRD, KSEB, JD-LSGD, DMO	Review Status
8	21/07/2024	5.30-6.30 pm	Emergency meeting-Tahsildars, Geology, Soil, PRD, KSEB, JD-LSGD, DMO	Review Status
9	22/07/2024	10.45-11.45 am	Emergency meeting-Regarding rise in water level of Bansura Dam-Tahsildars, Geology, Soil, PRD, KSEB, JD-LSGD, DAM Authorities	Review Status

On 29th July 2024 after receiving heavy rainfall information from a local resident the District Panchayath President who is also the Co-chairperson of the District Disaster Management Authority visited multiple panchayaths, leading the local police, revenue and fire and rescue services and the representatives of the grama panchayaths and took initiative to proactively evacuate families living in vulnerable areas from the morning of 29th July 2024. He also visited Meppadi Grama Panchayath and along with the Grama Panchayath President and officials evacuated vulnerable families from Punchirimattam settlements. The team evacuated 15 individuals from Punchirimattam noticing a small landslide and alerted 50 individuals, some of whom left Mundakkai and Punchirimattam to the houses of relatives. Camp was also started in Chooralmala area. The District Panchayath President also alerted the Local Self Governments in the District Planning Committee meeting which was held on 29-7-2024 noon. Meppadi Grama Panchayath also issued a closure notice to all homestays in the area on 29-7-2024 and sent many people out of the panchayath and stopped many tourists from coming to reside there.

The India Meteorological Department issued Orange Alert on 29-7-2024, 1 pm in the District Level Rainfall Forecast for Kerala and Lakshadweep. Considering the possibility of landslides, landslide alerts were issued by State and Wayanad District Emergency Operations Centre and appropriate anticipatory evacuation was carried out by Revenue and Local Self Governments in various panchayaths.

Alerts and warnings were heeded to by many families resulting in saving lives.



District Rainfall Forecast For Kerala and Lakshadweep

29 July 2024

Time of Issue: 1300 HRS IST

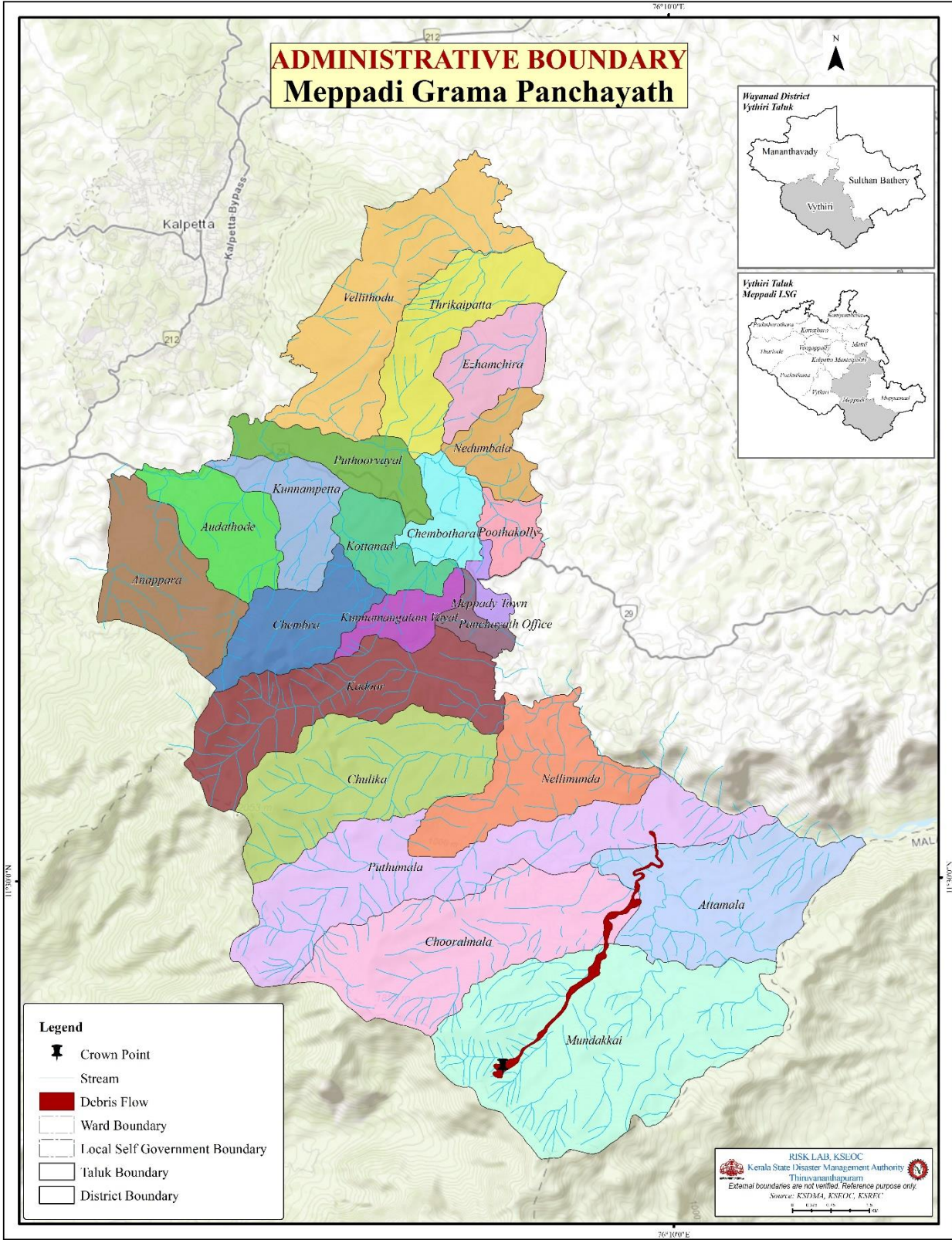
District		29-Jul	30-Jul	31-Jul	1-Aug	2-Aug
Thiruvananthapuram	Intensity:	ISOL. H	L to M	L to M	L to M	L to M
	Probability:	Very Likely	Very Likely	Very Likely	Very Likely	Very Likely
Kollam	Intensity:	ISOL. H	L to M	L to M	L to M	L to M
	Probability:	Very Likely	Very Likely	Very Likely	Very Likely	Very Likely
Pathanamthitta	Intensity:	ISOL. H	L to M	L to M	L to M	L to M
	Probability:	Very Likely	Very Likely	Very Likely	Very Likely	Very Likely
Alappuzha	Intensity:	ISOL. H	L to M	L to M	L to M	L to M
	Probability:	Very Likely	Very Likely	Very Likely	Very Likely	Very Likely
Kottayam	Intensity:	ISOL. H	L to M	L to M	L to M	L to M
	Probability:	Very Likely	Very Likely	Very Likely	Very Likely	Very Likely
Ernakulam	Intensity:	ISOL. H	ISOL. H	L to M	L to M	L to M
	Probability:	Very Likely	Very Likely	Very Likely	Very Likely	Very Likely
Idukki	Intensity:	ISOL. H	ISOL. H	L to M	L to M	L to M
	Probability:	Very Likely	Very Likely	Very Likely	Very Likely	Very Likely
Thrissur	Intensity:	ISOL. H	ISOL. H	L to M	L to M	L to M
	Probability:	Very Likely	Very Likely	Very Likely	Very Likely	Very Likely
Palakkad	Intensity:	ISOL. H	L to M	L to M	L to M	L to M
	Probability:	Very Likely	Very Likely	Very Likely	Very Likely	Very Likely
Malappuram	Intensity:	ISOL. H to VH	ISOL. H	L to M	L to M	L to M
	Probability:	Very Likely	Very Likely	Very Likely	Very Likely	Very Likely
Kozhikode	Intensity:	ISOL. H to VH	ISOL. H	ISOL. H	ISOL. H	L to M
	Probability:	Very Likely	Very Likely	Very Likely	Very Likely	Very Likely
Wayanad	Intensity:	ISOL. H to VH	ISOL. H	L to M	L to M	L to M
	Probability:	Very Likely	Very Likely	Very Likely	Very Likely	Very Likely
Kannur	Intensity:	ISOL. H to VH	ISOL. H	ISOL. H	ISOL. H	L to M
	Probability:	Very Likely	Very Likely	Very Likely	Very Likely	Very Likely
Kasaragode	Intensity:	ISOL. H to VH	ISOL. H	ISOL. H	ISOL. H	L to M
	Probability:	Very Likely	Very Likely	Very Likely	Very Likely	Very Likely
Lakshadweep	Intensity:	L to M	L to M	L to M	L to M	L to M
	Probability:	Very Likely	Very Likely	Very Likely	Very Likely	Very Likely

Intensity of Rainfall	
V L	Very Light Rainfall (0.1 to 2.4 mm)
L	Light rainfall (2.5-15.5 mm)
M	Moderate (15.6-64.4 mm)
H	Heavy Rainfall (64.5-115.5 mm)
VH	Very Heavy Rainfall (115.6-204.4 mm)
XH	Extremely Heavy Rainfall (>204.4mm)

Distribution of Heavy Rainfall	
Category	% of stations
ISOL	1-25
SCT	26-50

Probability of Occurrence (%)	
Likely	25 - 50
Very Likely	51 - 75
Most Likely	> 75

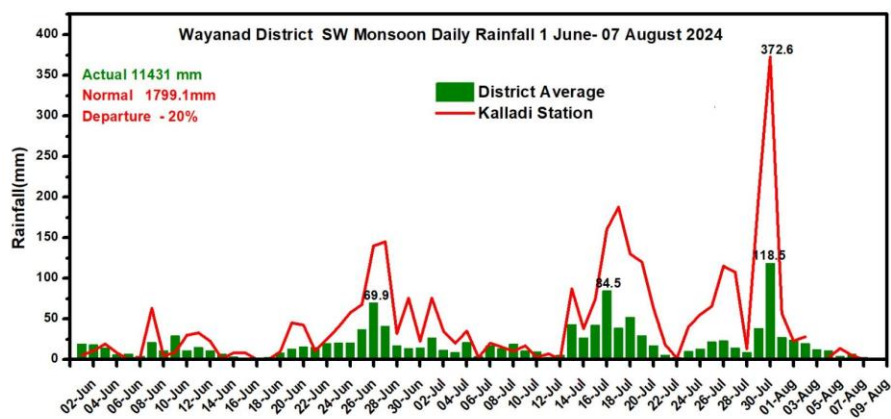
Warning Colour Codes	
Warning (Take Action)	
Alert (Be Prepared)	
Watch (Be Updated)	
No Warning (No Action)	



1.3. Meppadi Landslide 30-7-2024

Meppadi Grama Panchayath is in Vythiri Taluk of Wayanad district. Covering an area of 125.94 km² and with a population of 37,785, the panchayath has a population density of 300/km². On 30-7-2024, at around 1.15 am, a major landslide occurred in the arcute shape micro watershed of Punchiri Mattam Hill. The residents reported three consecutive sounds of rock rumbling and bursting, which is later understood to be a consequence of a massive debris slide, and consecutive landslide dams that ruptured.

The nearest official rainfall recording station is at Kalladi (5 kms to the north of the crown of the landslide) where the rainfall recorded on 29-7-2024 was 200.2 mm and 30-7-2024 was 372.6 mm. The rainfall recorded at Kalladi was twice the average rainfall of the district on 30-7-2024.

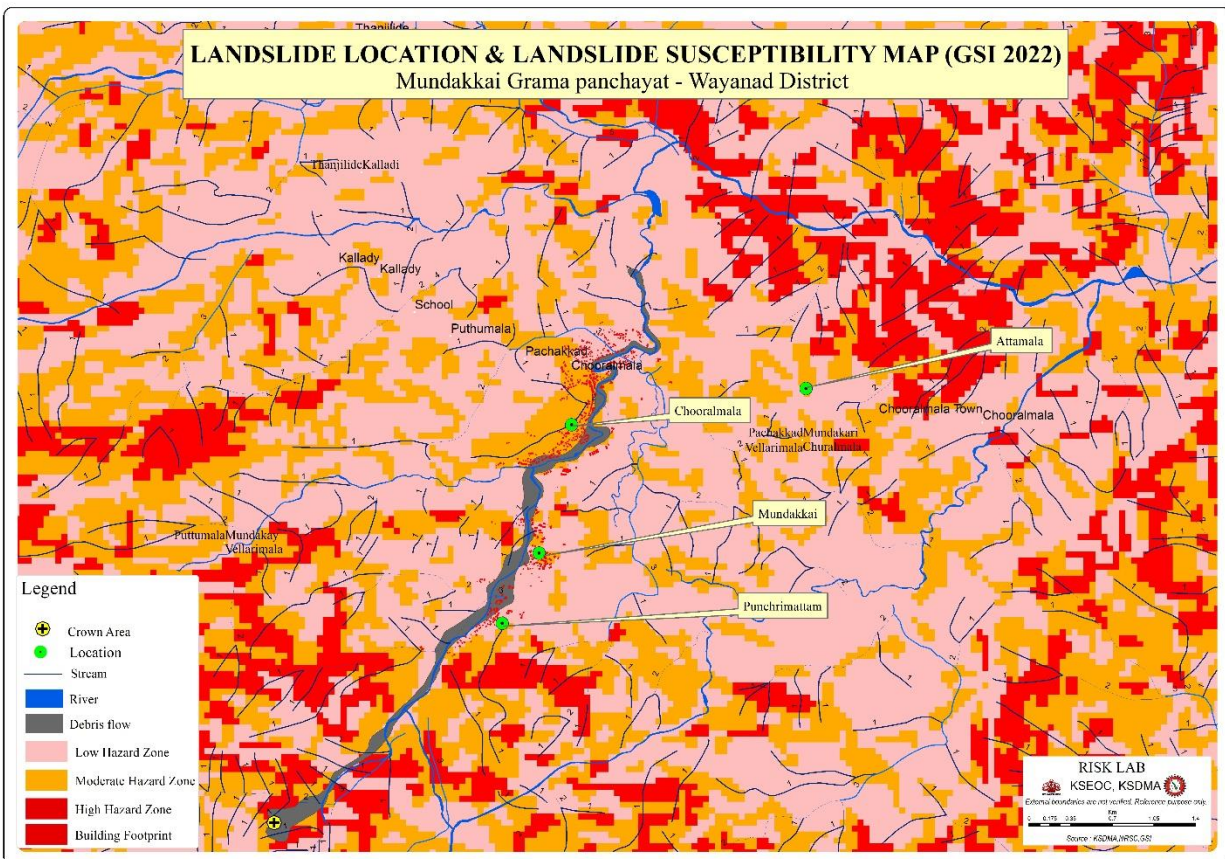


Salient features of the landslide are given below:

Landslide crown	Punchiri Mattam Evergreen Forest
Type of event	Debris slide turned debris flow that chanelised through Punapuzha (as in Topographic Sheet)
Affected area	57,8973.37 m ²
Length of the runout	8 km (from crown to deposition zone) travelled through P
Affected wards	10, 11, 12
Affected settlements	Punchiri Mattam, Mundakkai, Chooralmala and Attamala
Impact on geomorphology	20 to 40 m wide Panapuzha which is a tributary of Chaliyar River that experience the landslide and the consequent debris flow became 200 to 300 m wide

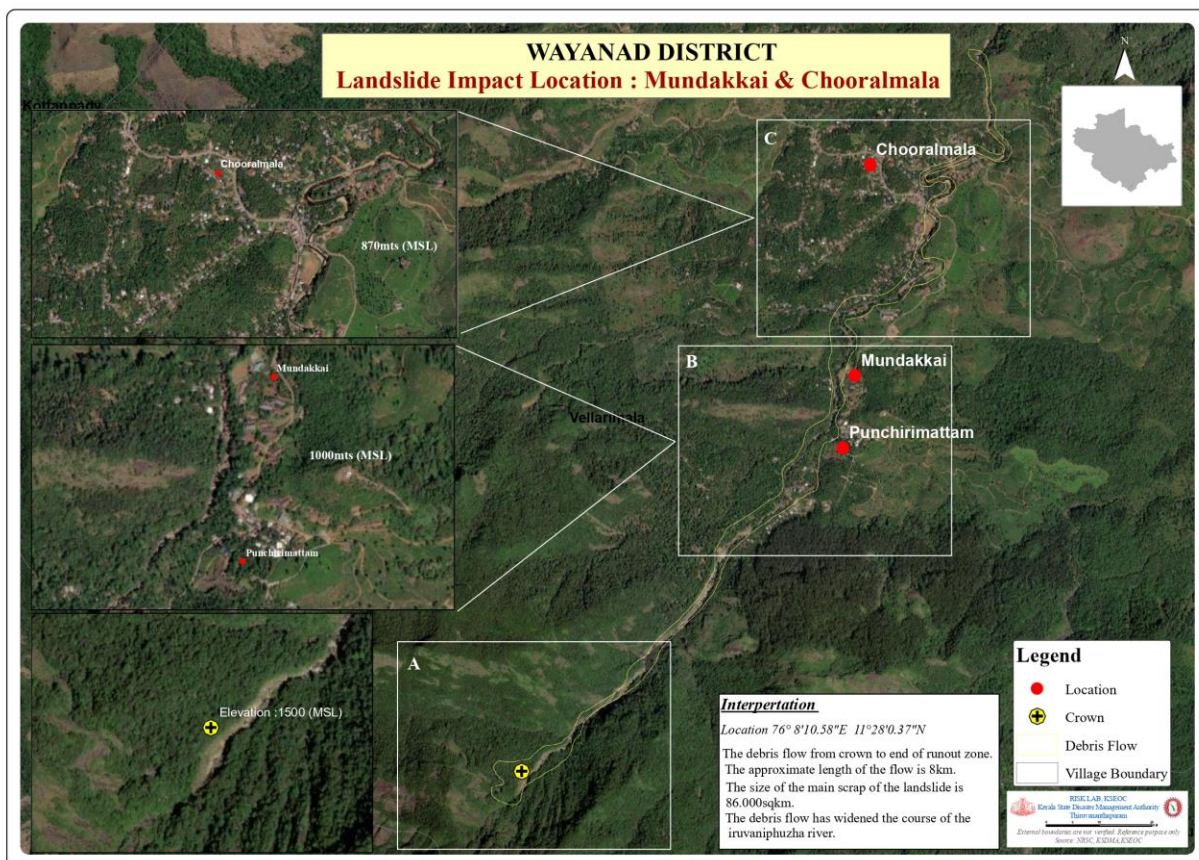
The Geological Survey of India reports (First Information Report in Mundakkai-Chooralmala areas, Meppadi Grama panchayat, Vythiri Taluk of Wayanad District, Kerala), the following: “Physiographically, the Mundakkai area lies on Wayanad plateau having a rugged terrain with ridges and valleys and its relative relief is around 1000m. The probable source of the

Mundakkai Debris flow is having an elevation of 1544 m and it is approximately 3 km and 5km from Mundakkai and Chooralmala villages respectively. Geomorphologically the source area is a part of moderately dissected slopes having a steep slope angle varies from ~25-40° with overburden thickness of <5m. The loose and unconsolidated nature of overburden material resulted in rising excess pore pressure within due to incessant rain is assessed to be the triggering factor for all these incidences. As far as land use land cover is concerned, the upslopes and midslopes in and around the source area are covered by thick forests and the affected areas include tea plantation and mixed crops. Geologically the area belongs to Southern Granulite Terrain (SGT) comprising rocks of Wayanad, charnockite and Migmatite groups.” The FIR of GSI also states the following as the geo-scientific causes of the landslide “The excessive rainfall is the major triggering factor which results in increase of pore water pressure and reduction of strength on super saturation initiated the slide. Toe erosion by streams.”



The search and rescue began immediately with the residents and Aapda Mitra’s of the area starting the initial rescue activities. There were 7 Aapda Mitras active in the area.

Aapda Mitras from the landslide affected location and panchayath and their activities		
SI No	Name	Activity
1	Ms. Alakananda V	Duty on the day of PM visit camp management for 2 days
2	Ms. Faseela PP	She is involved in the search operations for the first two days. After that, she is assigned to camp duties.
3	Mr. PrabhakaranV	He is involved in the search for 4 days, after that he is involved in camp management, currently he is the camp in charge
4	Mr. Sinsil T	He has been actively involved in the search operations up until today. His house is completely damaged. He lost his close relatives in the landslide
5	Ms. Sneha TP	She is involved in the search operation for one day and in camp management for one day
6	Mr. Unaf Y	He has been actively involved in the search operations up until today
7	Mr. Riyas P	He has been actively involved in the search operations up until today



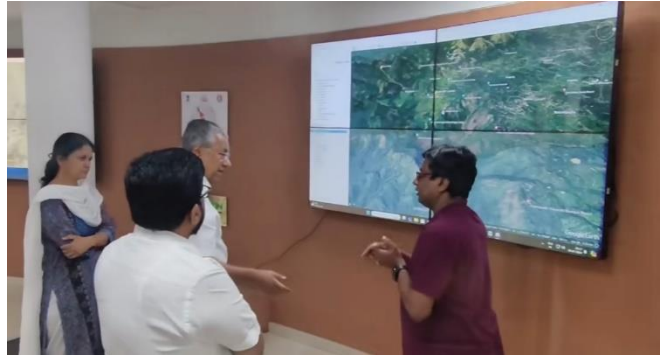
Sequence of actions are given below:

- 30-7-2024, 1.15 am: The first responders of the area (local community and Aapda Mitra) started the rescue work. The Panchayath representatives initially lead the rescue work

- 30-7-2024, 2.05 am: The State ERSS112 at State Emergency Operations Centre (SEOC), Thiruvananthapuram was informed of the event at 2:05 am
- 30-7-2024, 2.15 am: The Fire and Rescue Services, Police and Revenue reached the site between 1.45 am and 2.30 am (30-7-2024)
- 30-7-2024, 3.00 am: The District Administration lead by District Collector, Additional District Magistrate and the District Hazard Analyst reached the site around 3 am (30-7-2024)
- 30-7-2024, 3:49 am: First information of the Landslide to Additional Secretary (DM), MHA and Members of NDMA from SEOC
- 30-7-2024, 4:09 am: Location of the impact area was shared to NDMA and Forces from SEOC
- 30-7-2024, 4.30 am: The team of National Disaster Response Force (NDRF) who were prepositioned in Wayanad district from June 2024 anticipating extreme events reached the site by 4.30 am
- 30-7-2024, 4:55 am: Request for two teams of Defense Security Corps movement from Kannur to Wayanad (via email from SEOC with copy to NDMA Control Room)
- 30-7-2024, 5:38 am: Telephonic briefing to Member NDMA and Advisor OPS, NDMA from SEOC
- 30-7-2024, 5:49 am: Request for air reconnaissance support from Air Force (via email from SEOC with copy to NDMA Control Room)



- 30-7-2024, 7:30 am: Hon'ble Minister for Revenue reviewed the situation from State Emergency Operations Centre
- 30-7-2024, 9:00 am: Hon'ble Chief Minister chaired a meeting with senior officials at the State Emergency Operations Centre and issued specific directions to various agencies for ensuring speedy response and relief
- 30-7-2024, 10:26 am: Request for Madras Engineering Group (Engineering Task Force) support (via email with copy to NDMA Control Room)
- 30-7-2024, 10:42 am: Telephonic briefing to Additional Secretary (DM), MHA
- 30-7-2024, 10:53 am: Updated report to Additional Secretary (DM), MHA (via WhatsApp) and call
- 30-7-2024, 11:45 am: Request for river crossing team from Navy (INS Zamorin) support (via email with copy to NDMA Control Room)
- 30-7-2024, 12:13 pm: Request for cadaver dogs from Indian Army (Meerut) (via email with copy to NDMA Control Room)
- 30-7-2024, 01:08 pm: Updated report to Additional Secretary (DM), MHA (via WhatsApp) and call from SEOC
- 30-7-2024, 2:00 pm: Three Ministers, Minister for Revenue, Minister for PWD and Minister for Forests and Wildlife reached Wayanad district and reviewed the relief and response

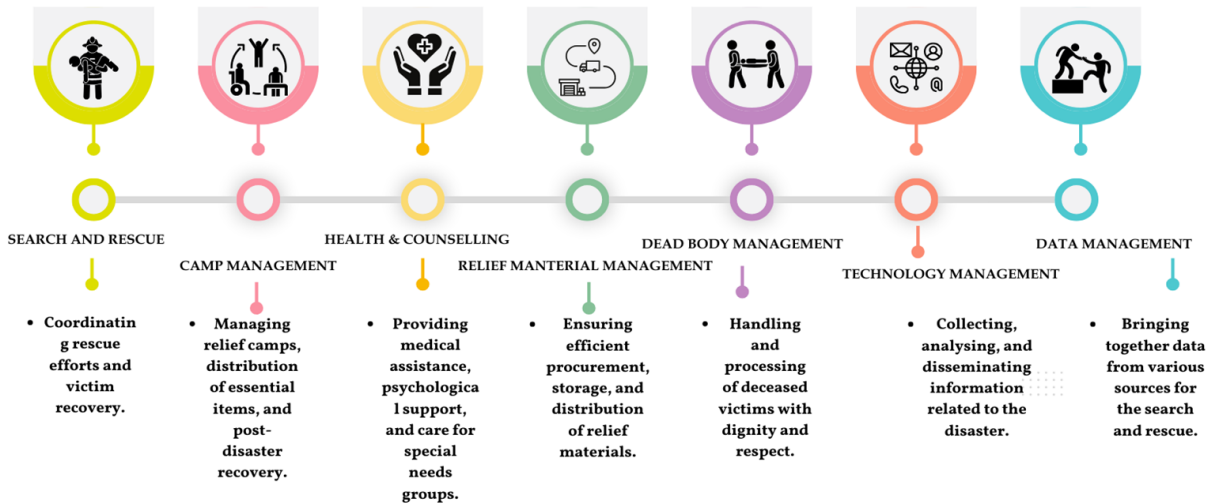


The deployment of Search and Rescue Forces over a period of 48 hours from the time of occurrence of the landslide was as follows:

Force	Number		Force	Number
Fire & Rescue	200		Civil Defence	200
Aapda Mitra	100		Police	300
NDRF	126		Defense Security Corps	100
Army	582		MEG (ETF)	1 Column
Air Force	2 helicopeters and multiple fixed wing		Army	Zaver & Recco Radars (5)
Army Cadaver Dogs	5 dogs		Navy	1 team

Coast Guard	2 units		Civil Society Organisations	Countless
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On an average, 5000 individuals were working in the area for search, rescue and salvaging within the first 24 hours of the event. Several systems were put in place to address the various needs of disaster response and relief which is concised in the following figure.



Technological aids were used to facilitate Search and Rescue:

1. GIS maps prepared using drone data and house location data
2. Contour Analysis using drone DEM data and old contour data to understand the loss of topography and the sludge deposition
3. Ground penetrating radars & Intelligent Buried Object Detection System
4. Information systems to track missing people, dead people and to manage camps



- Vide GO (P) No. 2/2024/DMD dated 9-8-2024 three wards of Meppadi Grama Panchayath, they being 10, 11 and 12 were notified as disaster affected.
- Hon'ble Chief Minister Minister visited the landslide affected areas on 3-8-2024 and reviewed the search and relief activities.
- The Inter Ministerial Central Team visited Wayanad on 9-8-2024 for assessing immediate relief
- Hon'ble Prime Minister visited the landslide affected areas on 10-8-2024 and reviewed the ongoing relief activities



2. Assessment of Response and Relief as per SDRF norms

2.1. Human Fatalities

A total of 231 bodies have been found and 128 are reported to be missing as on 15-8-2024. The total exgratia to be paid is Rs. 14,36,00,000/- (@Rs. 4,00,000/deceased).

2.2. Injuries

A total of 378 were injured and required hospitalisation of more than 1 week. The total gratuitous relief will be Rs. 60,48,000/-. It is estimated that as many as 25 individuals have disability of more than 60%. The total gratuitous relief in this account will be Rs. 62,50,000/-. Those who may be between 40 and 60% of disability is 70. The total gratuitous relief in this account will be Rs. 51,80,000/-.

Sl. No	Head	Amount (Rs)
1	Disability of more than 60% (25 individuals) [@Rs. 2,50,000]	62,50,000
2	Disability of 40 to 60% (70 individuals) [@Rs. 74,000]	51,80,000
3	More than 1 week hospitalisation (378 individuals) [@Rs. 16,000]	60,48,000
	Total	1,74,78,000

2.3. Clothing & utensiles

A total of 1555 houses were totally damaged and 452 houses were partially damaged. All of them lost clothing & utensiles. The total gratuitous relief in this account will be Rs. 1,00,35,000/- (Rs. 2500 - clothing and Rs. 2500 - utensiles).

2.4. Livelihood assistance

A total of 1555 houses were totally damaged and 452 houses were partially damaged. A total of 4102 individuals were in camps as on 1-8-2024. Amongst them 1871 individuals remained in the camps and 2231 individuals moved to the house of relatives. This had 2010 adults. Rounding to the nearest, the daily wage of MNREGA in Kerala is Rs. 300/day. These individuals will not be able to return to normal livelihood in the next 90 days. Therefore, the gratuitous relief that may have to be paid will be $300 \times 2010 \times 90 = \text{Rs. } 5,42,70,000/-$.

2.5. Search and Rescue Operations

The Search and Resuce involved over 5000 individuals and 150 heavy machinery. Salvaging operations are continuing and so is the search for missing individuals. The cost of this may be broken down as follows:

Sl. No	Head	Amount (Rs)
1	Transportation of volunteers and troops by road (actuals)	4,00,00,000
2	Food and water supply for volunteers and troops (actuals)	10,00,00,000
3	Accommodation for volunteers and troops (actuals)	15,00,00,000
4	Vehicles used for evacuation (actuals)	12,00,00,000
5	Construction of Bailey Bridge (allied work) (actuals)	1,00,00,000
6	Procurement of torches, rain coats, umbrella, and gumboots (actuals)	2,98,00,000
7	Medical care for volunteers and troops (actuals)	2,02,00,000

The amount is calculated because the search will continue for 10 more days. The Grama Panchayth is far away from townships and therefore the costs are higher, particularly in times of disaster.

2.6. Search and Rescue Operations - hiring of equipment

The Search and Resuce involved 150 heavy machinery and specialised equipment. The cost of this may be broken down as follows:

Sl. No	Head	Amount (Rs)
1	IBOD, Drone, Radars (actuals)	3,00,00,000
2	Heavy equipment (JCB, Hitachi, Cranes) (actuals)	15,00,00,000
3	DNA sampling of dead bodies (actuals)	3,00,00,000

2.7. Relief Measures - temporary accommodation

On 1-8-2024, as many as 17 relief camps were started to accommodate 4102 individuals. As many as 14 camps with 1871 individuals are still in the camps. The camps may continue for 30 days. The cost would be:

Sl. No	Head	Amount (Rs)
1	Food (actuals)	8,00,00,000
2	Clothing (actuals)	11,00,00,000
3	Medical Care (actuals)	8,00,00,000
4	Generator (actuals)	7,00,00,000

2.8. Relief Measures - air dropping

The air crafts of Indian Air Force were used for transporting troops, air lifting of rescued, air lifting of dead bodies, dropping of troops, VIP movement etc. The cost may be reimbursed in actuals and is estimated to be Rs. 17,00,00,000/ (actuals)-.

2.9. Relief Measures – drinking water supply

The houses in the affected grama panchayath wards in which families were staying had to be supplied with drinking water. This will continue for 30 days and is estimated to Rs. 4,00,00,000/- (actuals).

2.10. Clearance of affected areas – debris clearance

The debris spread over 1 km² needs to be cleared. The activity is ongoing and involves about 70 heavy equipment. The cost estimated to complete this activity including clearing of boulders and obstructions in the stream is per day Rs. 60,00,000/-. The activity will continue for about 60 days and can only be done on rain free days. Thus, the cost estimated is Rs. 36,00,00,000/- (actuals).

2.11. Draining of flood water

Many parts of the affected settlements had water ponding. This needed to be drained out. The cost estimated is Rs. 3,00,00,000/- (actuals).

2.12. Disposal of dead bodies

The unidentified bodies and body parts had to be buried after collecting DNA samples. The cost involved and estimated is

Sl. No	Head	Amount (Rs)
1	Burrying 359 bodies (@Rs. 75,000/body) (actuals)	2,76,75,000

2.13. Agriculture – removing of debris

Crops in 626 ha was affected of which 359 ha was of small and marginal farmers (SMF). The relief assistance for desilting will be Rs. 64,62,000/- (Rs. 18,000/ha).

2.14. Agriculture – Loss of land

Crops in 626 ha was affected of which 100 ha was of SMF which became temporary fallow. The relief assistance for desilting will be Rs. 47,00,000/- (@Rs. 47,000/ha).

2.15. Agriculture – Perennial crops (Small and Marginal Famers - SMF)

Crops in 626 ha was affected of which 359 ha was SMF. The area is famous for coffee and cardamom. The relief assistance therefore is Rs. 80,77,500/- (@Rs. 22,500/ha).

2.16. Agriculture – Perennial crops (non SMF)

Crops in 626 ha was affected of which 359 ha was SMF; 267 ha is that of 14 non-SMF. The relief assistance therefore is Rs. 6,30,000/- (@Rs. 22,500/ha limited to 2 ha per farmer).

2.17. Animal Husbandry – Cow

A total of 226 cows are lost as reported by Animal Husbandry and Diary Development Departments. These cows were of 75 farmers (@Rs. 37,500/cow limited to 3 cows per farmer). The relief assistance is therefore Rs. 84,37,500/-.

2.18. Animal Husbandry – Goat

A total of 165 goats are lost as reported by Animal Husbandry Department. These goats were of 27 farmers (@Rs. 4000/goat limited to 6 goats). The relief assistance is therefore Rs. 6,48,000/-.

2.19. Animal Husbandry – Poultry

A total of 1032 poultry (hen) are lost as reported by Animal Husbandry Department. These poultry were of 10 farmers (@Rs. 10,000/farmer). The relief assistance is therefore Rs. 1,00,000/-

2.20. Animal Husbandry – Cattle camp

One cattle camp was operated in the area for accommodating 65 cows. The camp was run for 15 days and therefore the relief assistance is Rs. 78,000/- (@Rs. 80/cow/day).

2.21. Animal Husbandry – Transport of fodder

The cost of transporting fodder and feed to the camp amounted to Rs. 9,80,000/- (actuals).

2.22. Handicrafts – artisans

The impacted area had 14 artisans. Their livelihood was impacted and they lost their equipment and raw materials. The relief assistance is therefore:

Sl. No	Head	Amount (Rs)
1	Equipment (14 x Rs. 5000)	70,000
2	Raw materials (14 x Rs. 5000)	70,000

2.1 Relief in Loan Repayment (Section 13 of DM Act 2005)

Vide Section 13 of Disaster Management Act, 2005 "Relief in loan repayment, etc. - The National Authority may, in cases of disasters of severe magnitude, recommend relief in repayment of loans or for grant of fresh loans to the persons affected by disaster on such concessional terms as may be appropriate." Many families in Ward 10, 11 and 12 of Meppadi Grama Panchayath has lost their head of the family or the earning member. These families who were impacted cannot be expected to rebound to normal life soon. Therefore, it is requested that National Disaster Management Authority may consider writing off the personal loans, motor vehicle loans and housing loans of the affected families.

2.2 MGNREGA 2005 - additional working days

Vide Section 4.2.3 of the Annual Master Circular 2024-25 of MGNREG "In exercise of the provisions under Section 3(4) of Mahatma Gandhi NREGA, the Central Government has decided to provide up to an additional 50 days of unskilled manual work in a financial year, over and above the 100 days assured to job card holders in such rural areas where drought or any natural calamity (as per Ministry of Home Affairs) has been notified. The notification to provide up to additional 50 days of unskilled manual work, over and above 100 days in drought or natural calamity notified rural areas, is issued by the Ministry of Rural Development as recommended by Ministry of Agriculture & Farmers Welfare.". Therefore, the Ministry of Agriculture and Farmers Welfare may recommend to Ministry of Rural Development for granting 50 days of additional unskilled manual work in the financial year 2024-25 to Meppadi Grama Panchayath. A formal request from Principal Secretary, Local Self Government Department of Kerala to Secretary, Ministry of Rural Development, Govt. of India [DO. No. DD2/191/2024-LSGD dated 08-08-2024] has been submitted.

3. Assessment of Recovery & Reconstruction as per SDRF norms

3.1 Housing - severely damaged

A total of 1555 houses were totally or severely damaged. This is a hilly area. The area only has pucca houses. Therefore, the recovery cost as per norms is Rs. 20,21,50,000/- (@Rs. 1,30,000/house).

3.2 Housing - partially damaged

A total of 452 houses were partially damaged. This is a hilly area. The area only has pucca houses. Therefore, the recovery cost as per norms is Rs. 29,38,000/- (@Rs. 6,500/house)

3.3 Housing - huts

A total of 35 huts were damaged. Therefore, the recovery cost as per norms is Rs. 2,80,000/- (@Rs. 8000/hut)

3.4 Housing - cattle shed

A total of 111 famers lost their cattle shed. Therefore, the recovery cost as per norms is Rs. 3,33,000/- (@Rs. 3000/shed)

3.5 Roads & bridges

Sl. No	Head	Amount (Rs)
1	Roads (1 km State Highway) (@Rs. 1,25,000/km)	1,25,000
2	Roads (14.15 km rural road) (@Rs. 75,000/km)	10,61,250
3	Bridges (3) (@Rs. 75,000/bridge)	2,25,000

3.6 Drinking water supply schemes

Sl. No	Head	Amount (Rs)
1	Damaged drinking water supply schemes (8) (@Rs. 2,00,000/km)	16,00,000
2	Cleaning of 25 wells (@Rs. 10,000/well)	2,50,000

3.7 Power

Sl. No	Head	Amount (Rs)
1	Transformer (2) (@Rs. 1,00,000/transformer)	2,00,000
2	Poles (616) (@Rs. 5000/pole)	30,80,000
3	LT Lines (124 km) (@Rs. 50,000/km)	62,00,000

3.8 School

Sl. No	Head	Amount (Rs)
1	School (3 schools) (@Rs. 2,00,000/school)	6,00,000

3.9 Heath centre

Sl. No	Head	Amount (Rs)
1	Health Centre (4) (@Rs. 2,00,000/school)	8,00,000

3.10 Community assets

Sl. No	Head	Amount (Rs)
1	Community hall (12) (@Rs. 2,50,000/building)	30,00,000
2	Kudumbashree (Women Self Help Group) meeting rooms, pump houses, generator rooms, Yuva kendra, libraries, Panchayath owned commercial building (121) (@Rs. 2,50,000/building)	3,02,50,000
3	Anganwadi (3) (@Rs. 2,50,000/building)	7,50,000

4. Total assessment as per SDRF Norms and Actuals

Sl. No	Item	SDRF Norms (Rs)	Actual Loss (Rs)
A) Response & relief			
1a	Gratuitous relief – Human fatalities (359)	14,36,00,000	-
1b	Disability of more than 60% (25 individuals)	62,50,000	6,25,00,000
1b	Disability of 40 to 60% (70 individuals)	51,80,000	5,18,00,000
1c	Injury – more than 1 week hospitalisation	60,48,000	6,04,80,000
1d	Clothing & utensils (2007 families)	1,00,35,000	27,00,00,000
1e	Livelihood assistance (2010 individuals x Rs. 300 x 90 days)	5,42,70,000	14,00,00,000
2a	Search and rescue operations	47,00,00,000	47,00,00,000
2b	Search and rescue – hiring of equipment	21,00,00,000	21,00,00,000
3a	Relief measures – temporary accommodation	34,00,00,000	34,00,00,000
3b	Relief measures – Indian Air Force	17,00,00,000	17,00,00,000
3c	Relief measures – drinking water supply	4,00,00,000	4,00,00,000
4a	Clearance of affected areas – debris clearance	36,00,00,000	36,00,00,000
4b	Draining of flood water	3,00,00,000	3,00,00,000
4c	Disposal of dead bodies (359)	6,28,25,000	6,28,25,000
5(i)(A)(b)	Agriculture – removing of debris (359 ha)	64,62,000	7,00,00,000
5(i)(A)(d)	Agriculture - loss of land (100 ha)	47,00,000	14,00,00,000
5(i)(B)(b)	Agriculture – perennial crops – SMF (359 ha)	80,77,500	14,36,00,000
5(ii)	Agriculture – perennial crops – Non-SMF (267 ha)	6,30,000	13,35,00,000
6 (i)	Animal husbandry – Cows (226)	84,37,500	4,52,00,000
6 (i)	Animal husbandry – Goat (165)	6,48,000	82,50,000
6 (i)	Animal husbandry – Poultry (1032)	1,00,000	2,06,400
6 (ii)	Animal husbandry – cattle camp	78,000	10,00,000
6 (iii)	Animal husbandry – Transport of fodder	9,80,000	9,80,000
8 (i)	Assistance to Artisans – equipment (14)	70,000	14,00,000
8 (ii)	Assistance to Artisans – raw materials (14)	70,000	14,00,000
Total		193,84,61,000	281,31,41,400
B) Recovery & reconstruction			
10 (a) (i)	Housing - Fully damaged/severely damaged (1555)	20,21,50,000	233,25,00,000
10 (b) (i)	Housing - Partially damaged (452)	29,38,000	9,04,00,000
10 (c)	Housing – huts (35)	2,80,000	5,00,000

10 (e)	Housing – cattle shed (111)	3,33,000	18,00,000
11 (1)	Roads – State highway (1 km)	1,25,000	5,00,00,000
11 (1)	Roads – Rural Road (14.15 kms)	10,61,250	1,13,20,000
11 (1)	Bridges (3)	2,25,000	13,00,00,000
11 (2)	Drinking water supply – damaged platforms (8)	16,00,000	4,50,00,000
11 (2)	Drinking water supply – cleaning of wells (25)	2,50,000	12,00,000
11 (4)	Power – transformers (2)	2,00,000	32,00,000
11 (4)	Power – Poles (616)	30,80,000	9,24,00,000
11 (4)	Power – LT lines (124 kms)	62,00,000	3,72,00,000
11 (5)	Schools (3)	6,00,000	18,00,00,000
11 (6)	Health Centre (4)	8,00,000	14,00,00,000
11 (7)	Community assets (136)	3,40,00,000	21,76,00,000
Total		25,38,42,250	333,31,20,000
Grand total		219,23,03,250	614,62,61,400
Non SDRF items			
Damages to Tourism assets			50,00,00,000
Livelihood loss to allied sectors depended on agriculture			15,00,00,000
Livelihood loss to allied sectors depended on tourism			23,00,00,000
Damage to Government Assets			56,00,00,000
Vehicles lost			26,00,00,000
Damages to MSME			53,00,00,000
Livelihood loss to MSME sector			19,00,00,000
Damage to religious institutions			18,00,00,000
Cultural assets of Scheduled Tribe abodes			27,00,00,000
Damage to side protection walls			60,00,00,000
Damage to river training structures			30,00,00,000
Damage to storm water drains			36,00,00,000
Loss to cooperative societies			18,50,00,000
Loss to tea factories			27,00,00,000
Loss to drying units			35,00,00,000
Damages to check dams			16,00,00,000
Losses to banks			19,00,00,000
Damages to sockpits			23,00,00,000
Losses to real estate			36,00,00,000
Total			587,50,00,000
Grand total (actual)			1202,12,61,400

5. Build back better – Concept of a resilient township

The catastrophic landslide in Wayanad has underscored the urgent need for a sustainable and resilient urban development model. The disaster caused extensive loss of life and infrastructure, highlighting vulnerabilities in the region's current settlement patterns and urban planning.

- **Resilience and Adaptability:** Develop infrastructure and housing that withstands natural disasters and accommodates the unique challenges of hilly terrains.
- **Integration of Nature and Human Habitats:** Design a township layout that preserves biodiversity and promotes sustainable land use.
- **Economic Vitality:** Foster economic growth through the development of agriculture, eco-friendly tourism, and local skill development.
- **Community Engagement:** Encourage active participation of local residents in the planning and rebuilding process, ensuring inclusivity and a sense of ownership.
- **Sustainable Development Goals Alignment:** Ensure that the township's development aligns with global sustainable development goals, focusing on resilience, environmental sustainability, and social equity.

It is imperative to adopt settlement patterns that minimize environmental impacts while ensuring safety and comfort for residents. Homestead-style settlements that integrate residential and agricultural uses are particularly suited for the region's agro-based economy.

About Wayanad, there are 4 major categories of residents:

- Farmers/cultivators
- Laborers/workers
- Supporting population/service community
- Tourists/visitors

1. Settlement Layout

A combination of terraced farming models and homestead style settlement model is an appropriate settlement layout taking Wayanad hilly terrain in account. The structure of the farming settlement is decentralized, promoting independence while fostering a close-knit community through shared facilities like workshops, markets, and schools. Each terrace is bordered by a small retaining wall made of stone or other local materials to hold soil and water. The pattern follows the natural contour of the hill, with a series of terraces ascending the slope.

Settlements can be located on or near these terraces, typically in clusters, to facilitate easy access to farmland.



Fig 1: Terraced Farming Model for an agri-based township

This model maximizes land use efficiency and minimizes soil erosion by slowing down water flow. Paths and small roads connect the homesteads, allowing for easy transportation and communication.

2. Housing and livelihood options

Wayanad should consider adopting resilient and incremental housing approaches given its unique environmental, social, and economic context. It is advisable for the government to provide basic infrastructure for each housing unit and allow provisions for incremental methods of development for future expansions and customizations

Resilient housing: Incorporating concepts like Elevated and Stilt Housing reduces the risk of damage from soil erosion and waterlogging. Allows for water flow underneath, minimizing the impact on the natural terrain.

Incremental housing: Incremental method of development gives the owners the freedom to spontaneously perform extensions of their housing based on their future needs and resources, thus allowing diversity and customization depending on different drivers and motivations of the occupants.

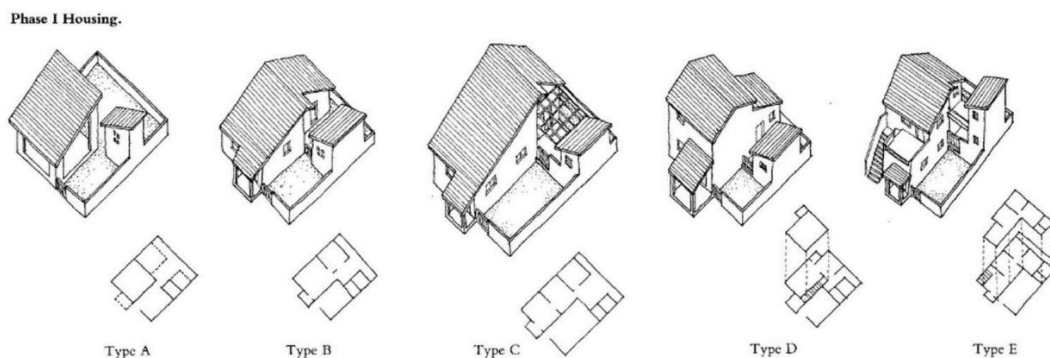


Fig 2: Incremental Housing, Belapur

3. Tourism and Agriculture as Economic Drivers

The tourism sector is undeniably one of the major economic drivers of Wayanad, and its importance cannot be overlooked. The potential for tourism in Wayanad, focusing on nature tourism, farm tourism, and eco-friendly resorts, is to be explored. The development of interpretation centers and tourist facilitation centers shall be proposed.

Opportunities for integrating tourism with agriculture, such as offering homestays, farm tours, and local produce markets, can be highlighted. The establishment of community and skill development centers to enhance local skills and provide additional livelihood opportunities is suggested.

Ultimately, this resilient township model serves as a blueprint for creating sustainable and resilient urban environments in hilly and ecologically sensitive regions, showcasing the potential for harmonizing human settlements with the natural landscape while promoting social equity, economic vitality, and environmental stewardship.

5.1 A rough costing for a resilient township

Rough Cost Estimates			
Department		Items	Cost (Cr)
Community Micro Irrigation	1	Water supply system from nearest fresh water source	20
	2	Community irrigation project	2.5
	3	Water management activities	8
		Total	30
Dairy Development Department		Items	Cost
	1	Mini Dairy Unit – Single Cow Units	53
	2	Mini Dairy Unit – Two Cow Units	168.8
	3	Mini Dairy Unit - Five Cow Units	84.6
	4	Renovation of existing cattle sheds	40
	5	Need Based Assistance for existing Dairy Farmers	50
	6	Rehabilitation of labour class in Plantation Area	41.4
	7	Fodder Development Programme	18.6
	8	Milk based MSME	17
9	Bulk Milk Chilling Units	84	

	10	Transportational assistance to Dairy Co-operatives	2.52
	11	Managerial Assistance to 3 Dairy Co-operatives	6.48
	12	Milk value addition	146
	13	Comprehensive insurance coverage for animal husbandry	33.85
	14	Community bio gas distribution hub	4.5
	15	Miscellaneous and Other unforeseen expenses	1.25
		Total	7.52
		Items	Cost
PWD	1	Construction of houses	120
	2	Social impact studies	10
	3	Land Development	120
	4	Educational Institutions	50
	5	Health Facilities	50
	6	Community centers, public spaces and recreational areas, playground	100
	7	Road development	250
	8	Electrification and drinking water supply	250
	9	Transportation facilities	150
	10	Cattle rearing	150
	11	Government Office Complex	100
	12	Development of agricultural	150
	13	Land value	350
	14	Procurement for land	100
	15	Miscellaneous and other unforeseen expenses	50
		Total	2000
		Items	Cost
Dept. of Industries & Commerce. District Industries Centre Wayanad	1	Commercial & Industrial Establishments	21
	2	Household units	6
	3	Rural Transport units	3
	4	Fish/Meat Market	1
	5	Craft village	25

	6	Capacity Building	3
	7	Building Construction	30
	8	Pooled Fund/Misc.	10
	9	Implementation Expenses	1
		Total	100
		Items	Cost
Disaster Resilient Features	1	Local Response Centre – Police Station, Fire and Rescue Station, Civil Defence Centre & Community Capacity Building Centre	60
	2	Community Forests	6
	3	Community Hazard Monitoring and Early Warning Centre	6
	4	Community water harvesting system	15
	5	Risk Pool for risk transfer (corpus to begin)	50
			Total
		Items	Cost
Agriculture	1	Formation of Farmers Interest Groups (FIGs)	2
	2	FIGs capacity building, Nurseries, Sapplings, Poly Houses, Marketing Centre etc	1.35
	3	Value addition, common facilitation centres and machinery	20
	4	Contingency	1.5
		Total	25
		Grand total	2262

6. Photos





Submitted by

A handwritten signature in blue ink that reads "Tinku Biswal".

Tinku Biswal IAS
State Relief Commissioner &
Principal Secretary, Disaster Management

17-8-2024

PROFORMA

(Rs. in crore)

(A) Statement containing State's share of contribution, up to date expenditure and the balance amount in the State Disaster Response Fund (SDRF/NDRF)		
1.	Opening balance as on 01.04.2023	165.43
2.	Centre's Share including advance release credited to SDRF 2023-24	277.60
3.	Corresponding Share of State during 2023-24	92.00
4.	Corresponding share of State credited to SDRF	92.00
5.	Amount received under NDRF during 2023-24	-
6.	Corresponding share of State credited to NDRF	-
7.	Expenditure as on 30 th September 2023	
8.	Cumulative Expenditure as on 31 st March 2024	166.28
9.	Amount Transferred to investment account during 2023-24	
10.	Amount received from investment account (including interest earned) during 2023-24	26.20
11.	Closing balance (1+2+4+5+6+10) – (7 or 8) : 31 st March 2024	394.95
(B)		394.95
1.	Opening balance: 1st April 2024	
1.1	Total investment made out of SDRF as on 31 st March 2024	
2	Receipt during the current financial year 2024-25	
(i)	Centre's share of SDRF	145.60

(ii)	State's Share of SDRF	48.40
(iii)	Assistance under NDRF -Central share	-
(iv)	Corresponding State share of NDRF	-
(v)	Interest earned (including investment made out of SDRF)	-
(vi)	Others	-
(vii)	Arrears of Centre's / State's share if any to be credited to SDRF	-
(viii)	Total (i) to (vii)	
ix	Of which amounts credited to SDR	
3.	Total amount available in the SDRF $\{(1+2(ix))\}$	588.95
4.	Total Expenditure incurred in conformity with items & norms of SDRF during the year out of the Fund	30.13
5.	Balance available in the fund (3-4)	558.82
(C) Submission of 'Annual Report on Natural Calamities'		
(i)	Whether "Annual Report on Natural Calamities" for the previous year 2023-24 has been sent to Ministry of Home Affairs (Yes / No)	No
(ii)	If yes, date on which sent	



Tinku Biswal

TINKU BISWAL IAS
Principal Secretary
Revenue & Disaster Management and Housing Department
Government of Kerala
Thiruvananthapuram