GOVERNMENT OF KERALA

Disaster Management (A) Department

No.DMA2/249/2024-DMD 13-11-2024,Thiruvananthapuram

From

Principal Secretary to Government

To

Sri. Sanjeev Kumar Jindal
Additional Secretary
Ministry of Home Affairs
(Disaster Management Division)
'C' Wing,3rd floor,NDCC-11
Jai Singh Road, New Delhi

Sir,

Sub: DMD- Meppadi landslide at Wayanad District- Post Disaster Needs Analysis (PDNA) Report- forwarding of-Reg

Ref: 1.GO(Rt)No.625/2024/DMD dated 23/08/2024
2.Your Letter no.13-04/2024-NDM-1 dated 18/10/2024

I am to invite your attention to the reference cited. State of Kerala went through the most catastrophic of landslides in its history on 30-7-2024 at Meppadi Grama Panchayath, Wayanad. The Inter-Ministerial Central Team constituted by the Ministry of Home Affairs visited the site on 09-08-2024 and the Hon'ble Prime Minister visited the site on 10-08-2024. The event has left about 2007 houses uninhabitable and will leave many without a livelihood for months to come if we do not adequately attend to their immediate needs. We look forward to the continued support of Government of India, especially in building back better. As desired in your letter cited above, the PDNA report for the Meppadi landslide is being enclosed for kind consideration for release of funds under R&R window of NDRF.

Yours Faithfully,

ANURADHA K C
ADDITIONAL SECRETARY





POST DISASTER NEEDS ASSESSMENT

MEPPADI LANDSLIDE 2024

WAYANAD, KERALA

About the cover picture

Thanking the brave humanitarians.....

The drawing, created with the heartfelt perspective of a child, is a powerful tribute to the courage and selflessness of humanity in times of crisis. Set against the backdrop of the disaster, it depicts three exceptional Aapda Mitra volunteers: Unaf, Sinsil, and Riaz, who, despite their personal losses during the devastating Meppadi landslide, stand tall as symbols of hope and resilience.

Similar to them many helping hands have reached out to the people of Mepppadi, their acts of bravery are not driven by the desire for recognition, but by a deep-rooted sense of responsibility toward their community. They embody the idea that even amid their own pain, true heroes rise to help others.

আমি ঘুমোলাম এবং স্বপ্ন "দেখলাম যে জীবন আনন্দ।
I slept and dreamt that life was joy.

আমি জাগলাম এবং দেখলাম যে জীবন সেবা।
I awoke and saw that life was service.

আমি কাজ করলাম এবং দেখলাম, সেবাই আনন্দ।"
I acted and behold, service was joy”

Rabindranath Tagore, Gitanjali

Tagore's reflection perfectly encapsulates the mission of all the voluntary help. Their response to the disaster is a testament to the belief that true joy is found in the service of others—that in moments of overwhelming loss and destruction, humanity's greatest strength is its ability to lift others up. These volunteers, even as they face their own grief, find joy in the act of service, offering hope to those around them.

In a world fraught with growing natural disasters and conflicts, this image stands as a reminder that humanity’s most enduring power lies in our collective compassion. It shows that even when the earth shifts and lives are torn apart, there are always those who rise above their personal suffering to bring relief, healing, and strength to others. Many of their dedication to their community, despite their own losses,embodies the essence of humanitarianism.

Through their actions, they teach us that even in moments of personal loss, we can find purpose and strength by reaching out to others. Their service becomes not just an act of survival, but a beacon of hope for all.

POST DISASTER NEEDS ASSESSMENT

MEPPADI LANDSLIDE 2024
WAYANAD, KERALA

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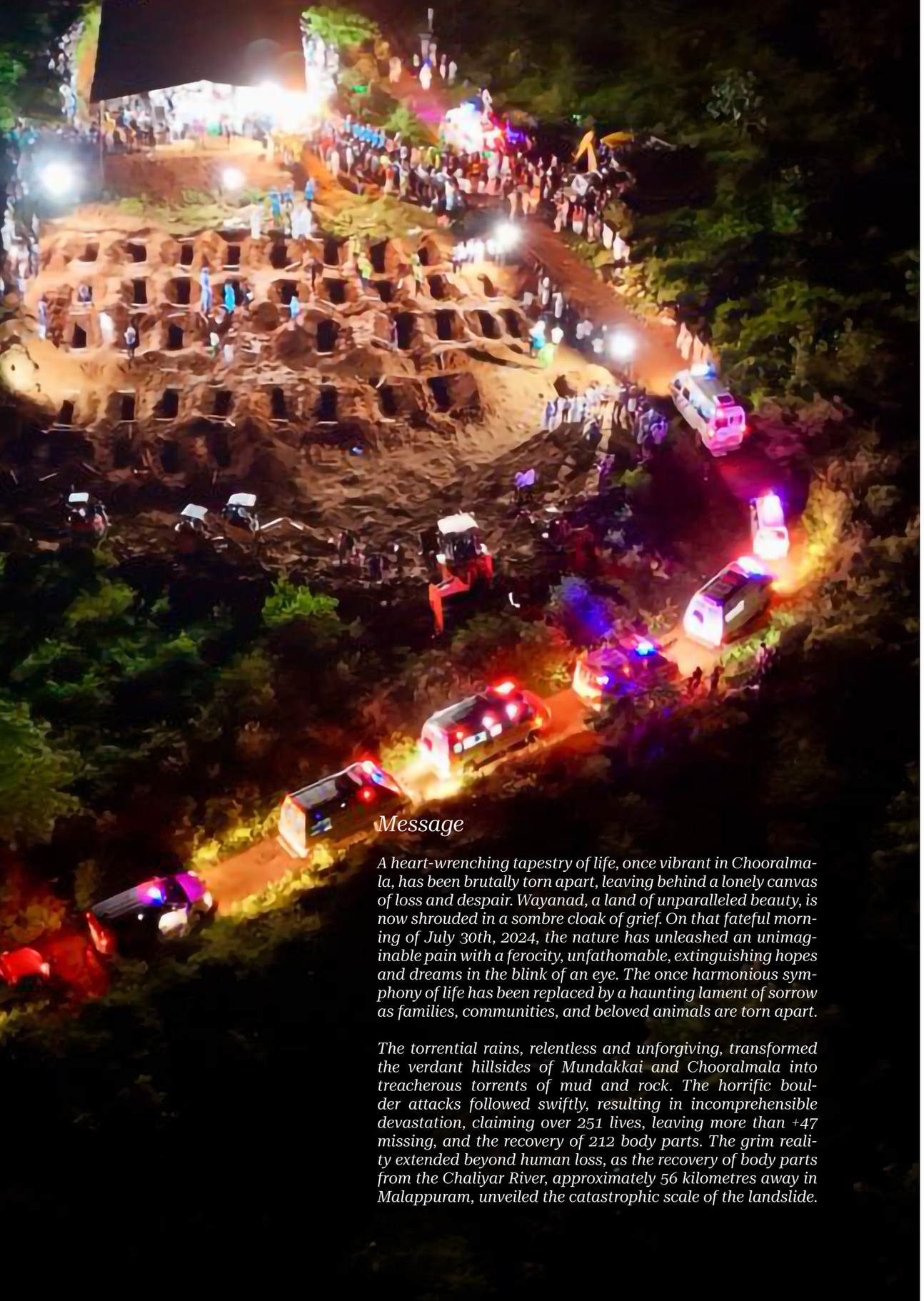

Message

A heart-wrenching tapestry of life, once vibrant in Chooralmala, has been brutally torn apart, leaving behind a lonely canvas of loss and despair. Wayanad, a land of unparalleled beauty, is now shrouded in a sombre cloak of grief. On that fateful morning of July 30th, 2024, the nature has unleashed an unimaginable pain with a ferocity, unfathomable, extinguishing hopes and dreams in the blink of an eye. The once harmonious symphony of life has been replaced by a haunting lament of sorrow as families, communities, and beloved animals are torn apart.

The torrential rains, relentless and unforgiving, transformed the verdant hillsides of Mundakkai and Chooralmala into treacherous torrents of mud and rock. The horrific boulder attacks followed swiftly, resulting in incomprehensible devastation, claiming over 251 lives, leaving more than +47 missing, and the recovery of 212 body parts. The grim reality extended beyond human loss, as the recovery of body parts from the Chaliyar River, approximately 56 kilometres away in Malappuram, unveiled the catastrophic scale of the landslide.

Acknowledgement

Kerala, home to over 33 million inhabitants, is a global paragon of human development. Notwithstanding its accomplishments, the state remains susceptible to the ravages of natural disasters and is categorized as a multi-hazard region. In recent years, the insidious march of climate change has intensified the frequency and ferocity of extreme weather events, particularly in Wayanad, where the severity of such occurrences has reached unprecedented levels.

In the wake of the catastrophic 2024 Meppadi Landslide, a Post-Disaster Needs Assessment (PDNA) was commissioned by Government of Kerala vide GO (Rt) No. 625/2024/DMD dated 23-8-2024.

The PDNA was conducted by officials of various State Government Departments, Universities, Research Organisations, Non-governmental agencies, experts, and sectoral specialists of Kerala State Disaster Management Authority (KSDMA) with the technical guidance of National Disaster Management Authority (NDMA). We extend our heartfelt gratitude to NDMA for their invaluable support in the conduct of PDNA and providing indispensable technical guidance.

We acknowledge the significant contributions of the state and district government departments for their unwavering support.

A profound expression of appreciation is extended to the community of Meppadi Grama Panchayat, who, despite their pains, selflessly assisted in the PDNA process.

Special commendation is bestowed upon the Wayanad District Disaster Management Authority, the District Administration, all relevant departments, and significant community members for their pivotal role in aiding the expert teams in conducting a meticulous assessment of the damages and losses.



ചൂരൽമലയിൽ
ഉരുൾപൊട്ടിയിട്ടുണ്ട്...
"...there is a landslide in
Chooralmala...
വീട്ടിലേയ്ക്കൊക്കെ
വെള്ളംകയറി...
... water has entered the house..."

These were the desperate words of a brave women who became one of the first responders to alert emergency services about the devastating landslide in Meppadi.

The path of volunteerism and humanitarian response is often laden with heartbreak. In Meppadi, many such courageous souls stood resolute against the fury of nature, driven not by duty but by an innate humanity that refused to yield. Yet, for some, their noble acts of defiance met a tragic silence, their voices extinguished as they surrendered to the depths of death, giving everything they had to save others.

These are the unsung heroes, whose sacrifices leave an indelible void yet resonate as a solemn reminder of the cost of courage and the profound weight of altruism in moments of despair.

This Post-Disaster Needs Assessment (PDNA) document stands as a poignant tribute—a dedication to all the beautiful souls who sacrificed their lives in the Meppadi landslide.

Foreword

Wayanad district of Kerala is inherently susceptible to natural hazards, particularly landslides, floods and extreme heat. It is the only district in Kerala which is listed in the Aspirational Districts Programme considering its socio-economic vulnerabilities. Its mountainous terrain, steep slopes, and heavy rainfall, exacerbated by the growing impacts of climate change, have heightened the district's susceptibility to extreme weather events. The devastating 2024 Meppadi landslide in Wayanad, one of the deadliest in Indian history, underscored this vulnerability.

Every disaster is an opportunity to build-back-better and increase the resilience of the affected community. Kerala did the first Post Disaster Needs Assessment (PDNA) in the country, post Kerala Floods 2018 and converted the PDNA into action through the Rebuild Kerala Development Programme. It is with this experience that Kerala embarked on this PDNA for providing a framework and facilitating the recovery, reconstruction and rehabilitation of Meppadi Landslide affected community.

This PDNA report provides a detailed analysis of the impact of the landslide that occured in the early hours of 30-7-2024 in Meppadi Grama Panchayath devastating the human settlements at Punchirimattom, Mundakkai and Chooralmala. The PDNA identifies critical recovery needs, and offers strategic recommendations for rehabilitation and reconstruction. Using the methodology outlined by the National Disaster Management Authority (NDMA), the report presents a comprehensive evaluation of disaster effects and impacts, addressing both tangible and intangible losses. It emphasizes the necessity of coordinated efforts by central and state governments, alongside public and private sectors, for effective recovery and reconstruction.

Remarkably, this PDNA is unprecedented in its assessment of intangible losses, providing a nuanced understanding of the socio-environmental fabric impacted by the disaster. By examining the community's cultural and social dimensions, it offers a comprehensive perspective on recovery requirements.

We hope this report serves as a valuable resource for policymakers in developing a comprehensive recovery plan. By gleaning learnings from this disaster, we aim to strengthen resilience and preparedness for future challenges, ensuring a more sustainable and secure future for Wayanad district.

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Abbreviations & Acronyms

AB - Aerial Bunched
ABC - Aerial bundled cables
ABR - Anaerobic baffled reactors
AC - Alternating Current
AC - Asbestos Cement
ACF - Activated Carbon Filters
ACSR - Aluminium Conductor Steel Reinforced
ADBP - Aspirational Districts Block Program
ADD - Acute Diarrheal Disease
ADP - Aspirational District Programme
ADS - Area Development Society
AEOs -Assistant Education Officers
AEUs - agroecological units
AH - Animal Husbandry
AI - Artificial Insemination
AI-Artificial Intelligence
AMC - Aizawl Municipal Corporation
AMD - Advanced Micro Devices
amsl - above mean sea level
ARD - Agricultural Research for Development
ASAP - Additional Skill Acquisition Programme Kerala
ASHA - Accredited Social Health Activist
ASHA - Assistance Scheme for Handicrafts Artisans
ASPD - Antisocial Personality Disorder
ATM - Automated Teller Machine
AWC - Anganwadi centres
AWS - Automated Weather Station
AYUSH - Ayurveda, Yoga & Naturopathy, Unani, Siddha and Homoeopathy
B. T. Road - Barrackpore Trunk Road
B.Ed - Bachelor of Education
B2B - Business-to-Business
BBB - Build Back Better
BMBC - Bituminous Macadam and Bituminous Concrete
BP Handle SS - BioVive Bard Parker Handle Stainless Steel
BPC - Block Project Coordinator
BRC-Block Resource Center
BSNL - Bharat Sanchar Nigam Limited
c/w – Carriageway
CAT - Category
CBO - Community-Based Organisation
CBSE - Central Board of Secondary Education
CCC - Cable - Cable -Cable
CCTV - Closed Circuit Television
CD - Cross Drainage
CDRC - Community Disaster Response Committee
CDS - Community Development Society
CEA - Central Electricity Authority
CFC - Central Finance Commissions
CFC - Common Facility Center
CGI - Corrugated Galvanized Iron
CHC - Community Health Centre
CKD - Chronic Kidney Disease
CO_2 - Carbon Dioxide
COHEART- Centre for One Health Educa-

tion, Advocacy, Research, and Training
CPCB - Central Pollution Control Board
CPHEEO - Central Public Health & En-vironmental Engineering Organisation
CPU - Central Processing Unit
CPWD - Central Public Works De-part-ment
Cr.- Crore
CRC - Cluster Resource Centers
CRN - Core Road Network
CSEB - Compressed Stabilized Earth Blocks
CSR - Corporate Social Responsibility
CT - Current Transformer
CTC - Cable - Transformer -Cable
CW - Constructed Wetland
CWC - Central Water Commission
DC - Direct Current
DCH - Drop, Cover, and Hold
DCPU - District Child Protection Unit
DCRC - Domestic Conflict Resolution Centre
DCSs - Dairy Cooperative Societies
DD - Dairy Development
DDE - Deputy Director of Education
DDMA - District Disaster Management Authority
DDMP - District Disaster Management Plan
DDR - Double Data Rate
DEO - District Educational Officer
DEOC - District Emergency Operation Centre
DFO - Divisional Forest Officer
DHS - Directorate of Health Services
DI -Deionized Tanks
DIET - District Institute of Education and Training
DIKDR - Disseminating Indigenous Knowledge for Disaster Resilience
DLP - Defect Liability Period
DLP - Digital Light Processing
DM - Disaster Management
DMD - Disaster Management Division
DMHP - District Mental Health Programme
DMO - District Medical Officer
DMP - Data Management Plan
DNA - Deoxyribonucleic Acid
DOE - Department of Energy
DP - Double Pole
DPC - District Project Coordinator
DPI - Dots Per Inch
DPO - District Project Officer
DR - Dry Rubble
DRM - Disaster Risk Management
DRR - Disaster Risk Reduction
DSL - Digital Single-Lens
DSR - Delhi Schedule of Rates
DT - Distribution Transformer
DTPC - District Tourism Promotion Coun-cil
DW – Dry Wall
DWCD - Department of Women and Child Development
ECCE - Early Childhood Care and Educa-tion
EcoDRR - Ecosystem-Based Disaster Risk Reduction
EDTV - Enhanced Definition Television
EP - Environment Protection
ERS - Emergency Restoration Systems
ERTs - Emergency Response Teams
ESD - Electrostatic Discharge
ESS - Entrepreneur Support Scheme
EV - Electric Vehicle
FA - Folic Acid
FCS - Full Climatic Station
FHCs - Family Health Centres
FIGs - Formation of Farmer Interest Groups
FPO - Farmers Producer Organisation
FSTP - Faecal Sludge Treatment Plant

FTCP- Field Technician Computing and Peripherals
G.O. - Government Order
GDP - Gross domestic product
GH - Government Hospital
GHSS - Government Higher Secondary School
GI - Galvanized Iron
GL - Ground Level
GLPS - Government Lower Primary School
GO - Government Order
GOI - Government of India
GOK - Government of Kerala
GP - Grama Panchayat
GR - Gratuitous Relief
GSI - Geological Survey of India
GST - Goods and Services Tax
GSVA - Gross State Value Added
GUPS - Government Upper Primary School
GVA - Gross Value Added
GVHSS - Government Vocational Higher Secondary School
GWD - Ground Water Development
H1N1 - Hemagglutinin Type 1 and Neur-aminidase Type 1
HD - High Definition
HDD - Hard Disk Drive
HDMC - Hospital Disaster Management Committee
HDMI - High-Definition Multimedia Inter-face
HDPE - High-Density Polyethylene
HDTV - High-Definition Television
HEM - Hospital Empanelment Module
HEOC - Hospital Emergency Operation Centre
HF - Holstein Friesian
HFC - Housing Facilitation Centre
HFL – High Flood Level
HH- Households
HIV- Human immunodeficiency virus
HKS - Haritha Karma Sena
HPST - Homoeopathic Psychosocial Sup-port Team
HR - Human Resources
HRD - Human Resource Development
HRED - Department of Hydro and Re-new-able Energy
HS - High School
HSRT – Hunar Se Rozgar Tak
HSS - Higher Secondary School
HT -High Tension
HU – Household Unit
HVRA - Hazard Vulnerability and Risk Assessment
HWCs - Health and Wellness Centres
IAG - Inter Agency Groups
IAS - Indian Administrative Services
IBOD - Intelligent Box Opening Device
IC - Integrated Circuit
ICDS - Integrated Child Development Services
ICE - Internal Combustion Engine
ICSE - Indian Certificate of Secondary Education
ICTC - Integrated Counselling and Testing Centre
IDDR -International Day for Disaster Re-duction
IDRB -Irrigation Design & Research Board
IDSP - Integrated Disease Surveillance Programme
IEC - Information, Education, and Com-munication
IFS - Integrated Farming Systems
IG - Inspector General
IMA - Indian Medical Association
IMAGE – Indian Medical Association Goes Eco-friendly
IMD - India Meteorological Department
IMHANS - Institute of Mental Health and

Neurosciences
IMR - Infant Mortality Rate
INCOIS - Indian National Centre for Ocean Information Services
INR - Indian Rupee
IPCC - Intergovernmental Panel on Climate Change
IPHS - Indian Public Health Standards
IPS - Indian Police Service
IRC - Indian Roads Congress
IS - Indian Standards
ISM - Indian System of Medicine
ISRO - Indian Space Research Organisa-tion
IST - Indian Standard Time
IUCDS - Inter University Centre for Disability Studies
IUD - Intrauterine Device
JHI - Junior Health Inspector
JJM - Jal Jeevan Mission
JPHN - Junior Public Health Nurses
KABCO - Kerala Agro Business Company
KATPS - Kerala Adventure Tourism Promotion Society
KFD - Kyasanur Forest Disease
KGMOA - Kerala Government Medical Officers' Association
KIIFB - Kerala Infrastructure Investment Fund Board
KILA - Kerala Institute of Local Administration
KITE - Kerala Infrastructure and Technology for Education
KLD - Kiloliters per Day
KLDB - Kerala State Livestock Development Board
KMS - Kerala Migration Study
KMSCL - Kerala Medical Service Corporation
KPBR - Kerala Panchayat Building Rules
KPIs - Key Performance Indicators
KSACS - Kerala State AIDS Control Society
KSDMA - Kerala State Disaster Management Authority
KSEB - Kerala State Electricity Board
KSEOC - Kerala State Emergency Oper-ation Centre
KSSM - Kerala Social Security Mission
KSTP - Kerala State Transport Project
KWA - Kerala Water Authority
LAN - Local Area Network
LCC - Land Capability Classification
LCD - Liquid Crystal Display
LED - Light Emitting Diode
LP- Lower Primary
LPD - Liters per Day
LSG - Local Self-Government
LSGD - Local Self Government Department
LSGIs - Local Self Government Institutions
LT - Low Tension
MCF - Material Collection Facility
MDR - Major District Roads
MEC - Monitoring and Evaluation Committee
MEG (ETF) - Montrose Environmental Group (Exchange-traded fund)
MGNREGS - Mahatma Gandhi National Rural Employment Guarantee Scheme
MHA - Ministry of Home Affairs
MHC - Mental Health Centre
MHPSS - Mental Health and Psychosocial Services
MMR - Maternal Mortality Ratio
MNREGA - Mahatma Gandhi National Rural Employment Guarantee Act
MSDP - Milk Shed Development Programme
MSL -Mean Sea Level
MSMEs - Micro Small Medium Enterprises
MSW - Master of Social Work
MTO - Multi Tasking Officer

NA - Not Applicable
NABARD - National Bank for Agriculture and Rural Development
NAS - National Accounts Statistics
NbS - Nature-based solutions
NCD - Non-Communicable Diseases
NCESS - National Centre for Earth Science Studies
NDMA - National Disaster Management Authority
NDRF - National Disaster Response Force
NFHS - National Family Health Surveys
NGO - Non-Governmental Organization
NH - National Highways
NHM - National Health Mission
NITI Ayog - National Institution for Transforming India Ayog
NMCG - National Mission for Clean Ganga
NOC - No Objection Certificate
NPV - Net Present Value
NRLM - National Rural Livelihoods Mission
NRV - non-return valve
NTCP - National Tobacco Control Programme
NTFPs - Non-Timber Forest Products
NTSC - National Television Standards Committee
NVMe - Non-Volatile Memory Express
O&M - Operations and Maintenance
ODF - Open Defecation Free
ODL - Open and Distance Learning
OEM - Original Equipment Manufacturer
OFOE - One Family One Enterprise
OH - One Health
OH - Over head
OPBRC - Output and Performance-based Road Contracts
OPD - Outpatient Department
ORS - Oral Rehydration Solution
OWC - Organic Waste Converter
PAL - Phase Alternate Lines
PCB - Printed Circuit Board
PDNA - Post-Disaster Needs Assessment
PDS - Public Distribution System
PHC - Primary Health Center
PHED - Public Health Engineering Department
PLC - Programmable Logic Controller
PMEGP - Prime Minister Employment Generation Program
PM-FMSPES- Pradhan Mantri Formalisation Of Micro Food Processing Enterprises
PMGSY - Pradhan Mantri Gram Sadak Yojana
PPE - personal protective equipment
PPP - Public-Private Partnership
PSC - Pre-Stressed Concrete
PSF - Pressure Sand Filter
PSS - Psychosocial Services
PTA - Parent Teacher Association
PTSD - Post Traumatic Stress Disorder
PVC - Polyvinyl chloride
PWD - Public Works Department
PwDs - Persons with Disabilities
R&B - Roads and Bridges
RAM - Random Access Memory
RARS - Regional Agricultural Research Station
RC - Reinforced Concrete
RCC - Reinforced Cement Concrete
RCP - Representative Concentration Pathway
REC - Rural Electrification Corporation Ltd.
RGM - Rashtriya Gokul Mission
RIDF - Rural Infrastructure Development Fund
RJ - Registered Jack
RKI - Resilient Kerala Initiative
RKSK - Rashtriya Kishor Swasthya Karyakram

RMMS - Road Maintenance and Management System
RMU - Ring Main Unit
RPM - Revolutions Per Minute
RR - Random Rubble
RRT - Rapid Response Team
RT - Responsible Tourism
RTE U DISE - Right to Education Unified District Information System for Education
SAPCC - State Action Plan on Climate Change
SBM - Swachh Bharat Mission
SCADA - Supervisory Control and Data Acquisition
SCD - Sickle Cell Disease
SCERT - State Council of Educational Research and Training
SDGs - Sustainable Development Goals
SDMC - School Disaster Management Club
SDO - Sub-Divisional Officer
SDRAM - Synchronous Dynamic Random Access Memory
SDRF -State Disaster Response Fund
SDTV - Standard-Definition Television
SECAM - Sequential Color and Memory
SEOC - State Emergency Operation Centre
SH - State Highways
SHGs - Self-Help Groups
SIHM - Institute of Hospitality Management
SJD - Social Justice Department
SKMJHS - Subha Krishna Memorial Jain High School
SKMJHSS - Subha Krishna Memorial Jain Higher Secondary School
SLBC - State Level Bankers' Committee
SLBP - Special Livestock Breeding Program
SMA - Sampoorna Manasikaarogyam
SMC - School Management Committee
SMD -Surface Mount Device
SMF - Small and Marginal Famers
SMPS - Switched Mode Power Supply
SOPs - Standard Operating Procedures
SPOS - School Police Officers
SRG - School Resource Group
SSD - Solid State Drive
SSFCW - Subsurface Flow Constructed Wet Land
SSK - Samagra Shiksha Kerala
ST - Scheduled Tribe
STDD- Scheduled Tribes Development Department
STP - Sewage Treatment Plant
TA - Technical Assistance
TB - Tuberculosis
TCP - Town & Country Planning
TMR - Total Mixed Ration
TOD - Time of Day
TWGs - Tribal Women Groups
UF - Ultrafiltration
UG - Under Ground
UHP - Ultra High Performance
ULCCS - Uralungal Labour Contract Co-operative Society
UNICEF - United Nations International Children's Emergency Fund
UP- Upper Primary
UPS - Uninterruptible Power Supply
US - United States
USB - Universal Serial Bus
UTP - Unshielded Twisted Pair
UV - Ultraviolet
VCB -Vacuum Circuit Breaker
VHSE - Vocational Higher Secondary Education
VHSS - Vocational Higher Secondary School
VIVA - Vilarchayilninnum Valarchayilakku
VLE - Village Life Experience
VT – Vertical Turbine
WCD - Women and Child Development

WHO- World Health Organization
WIMS - Wayanad Institute of Medical Sciences
WRD - Water Resources Department
WSS - Water Supply Schemes
WTP - Water Treatment Plant

Units

A - ampere
cm – centimeter
GB - Gigabyte
GHz - gigahertz
gms - grams
ha. – Hectare
HP – Horse Power
Kg. – kilogram
KMS- Kilometers
kV- kilovolt
kVA - Kilo-volt-amperes
L – Litre
Lm – Lumens
LPD – Liters per day
mA – milliamps
MB - megabyte
Mbps - Megabits Per Second
ml- milliliter
MLD - Million Liters per Day
mm- millimeter
mtr-meter
mv - Millivolts
MW - Megawatt
sq. mt.- square meter
Sq. m. - square meter
TB – terabyte
uF - microfarad
V – Volts
VA - volt-ampere
W - watt

Executive Summary

Background

Wayanad district, nestled within the Western Ghats, has a long history of landslides due to its geographical features and susceptibility to extreme weather events. While the district's central region is characterized by gentle slopes, the outer fringes bordering Kannur, Kozhikode, and Malappuram districts exhibit steeper slopes and swift-flowing streams, increasing the risk of landslides.Historical records indicate a recurring pattern of landslides in Wayanad, often triggered by heavy rainfall. Notable events include the Mundakkai landslide of 1984, the Kappikalam landslide of 1992, and the Puthumala disaster of 2019. These landslides have resulted in significant damage to infrastructure, loss of life, and disruption to livelihoods.

Recent landslides, such as those in Puthumala (2019) and Pettimudi (2020), demonstrate a shift in the nature of landslides in the region. These events involve the detachment of debris from forested areas and its transportation over longer distances along stream channels, resulting in widespread damage to structures and infrastructure.

The devastating landslide that ravaged Meppadi Grama Panchayat in Wayanad District, Kerala, has left a trail of destruction along both banks of the Punnapuzha River, extending from the landslide's epicenter to Soochippara waterfalls. Three localities, namely Punchirimattom, Mundakkai, and Chooralmala, were particularly hardhit due to their relatively dense settlement and substantial property damage.

Summary

The landslide in Wayanad has brought to light the critical vulnerabilities of the region, especially in the social sector, including housing, public infrastructure, health, education, and mental well-being. The affected area, spread across multiple wards, faced widespread damage across all categories of the social sector. Over 1300 houses were completely destroyed, and nearly 111 cattle sheds require reconstruction, highlighting the need for substantial financial intervention. In addition to housing, the destruction of educational institutions has disrupted the education of over 658 students. The disruption also extends to public health facilities and mental health, with a rising concern regarding the psychological impact on survivors.

The recovery and reconstruction of the social sector are critical not just for physical rebuilding but also for restoring livelihoods, social stability, and overall community well-being. The rehabilitation plan encompasses rebuilding homes with modern safety standards, rebuilding schools and healthcare facilities, and introducing mental health interventions. The Post-Disaster Needs Assessment (PDNA) conducted in the aftermath of the disaster offers a comprehensive evaluation of the damage and losses incurred across key sectors, highlighting the extent of devastation and identifying critical recovery needs for the region.

This summary outlines the significant impacts and recommended interventions in the social, infrastructure, productive, and cross-cutting sectors, as well as the assessment of intangible assets.

SOCIAL SECTOR

Housing and Settlements

It was noted that the affected region has in total 2007 housing units spread across ward nos. 10 (720 buildings), 11 (504 buildings), and 12 (783 buildings) respectively. Out of that, 1300 are Fully damaged, 104 are Severely damaged, 603 houses with Minor damages, and 111 cattle sheds need reconstruction. Damage cost of INR 227.37Cr. is estimated for fully damaged, severely damaged and minor damaged houses. The above-estimated damage cost also includes the damage to septic tanks in a similar proportion as adopted for the calculation of the damage cost of buildings. However, the unit cost of the recovery and reconstruction is higher than that of the damage cost since the latter includes BBB (Build Back Better) features.

It is important to note that the existing average total covered areas of the houses in Wayanad are far too high compared to the average Indian housing standards. In addition, housing provisions need to be considered in recovery for 42 Tribal families. Also, since rehabilitation efforts in the same area are not possible, the government has planned to develop two new townships. Therefore, the total reconstruction cost, including land development, is projected to be INR 1106.85 Cr.

Further, it is essential to ensure strict implementation of disaster resilient design, a provision for capacity building and formulation of a Facilitation Centre for 2000 HH have also been accounted for in the total recovery estimate of INR 6.4 Cr. Therefore, the total reconstruction and recovery cost is INR 1113.25 Cr.

Public Buildings and Civic Amenities

The total damage cost to commercial, community and public infrastructure is estimated at INR 8.1 Cr. These include 68 fully damaged and 18 partially damaged buildings. Under commercial infrastructure, 82 units were either fully or partially damaged accounting for INR 7.40 Cr. Two community buildings were damaged whose cost estimate is INR 0.48 Cr. The damage to 2 public buildings is estimated to be INR 0.22 Cr.

The reconstruction and recovery plans include a balance of physical and social components facilitating a holistic rehabilitation pathway for the affected population. The total reconstruction cost is projected to be INR 43.071 Cr., covering all aspects of infrastructural interventions including in-situ interventions at INR 1.511 Cr., township building for INR 40.230 Cr. and facilities for tribal communities at INR 1.33 Cr.

The recovery cost is estimated to be 17.941 Cr. considering the investment required for training and capacity building at INR 0.45 Cr, financial assistance for INR 16.25 Cr. including loan waivers for small businesses, service continuity at INR 3.75 Cr and DRR measures for INR 0.341 Cr. The combined reconstruction and recovery cost amounts to INR 61.011 Cr.

Education

Two educational institutions, the Government Vocational Higher Secondary School (GVHSS) Vellarmala and the Government Lower Primary School (GLPS) Mundakkai, were destroyed by the landslide. In total, the education of 658 students has been entirely disrupted, highlighting the urgent need for immediate intervention and support to restore the learning environment.

The total damage was estimated to be INR 9.09 Cr. Reconstruction and recovery efforts highlight both immediate and long-term interventions. Rebuilding new schools in the long term and allied infrastructure facilities including virtual have been incorporated in the reconstruction estimate of INR 15.975 Cr.

Additionally, provisions for makeshift arrangements for temporary schools, formulating pro-

grams such as career guidance and mentoring, enhancing technological infrastructure and building resilience through DRR initiatives have been accounted for in the total recovery estimate of INR 6.35 Cr.

The total reconstruction and recovery cost estimate stands at INR 22.325 Cr.

Health and Nutrition

The assessment reveals that the list of partially damaged infrastructures includes one Health and Wellness Centre (HWC), three Anganwadi Centres (AWCs), and one private dispensary with a laboratory and a private pharmacy. Further losses incurred by the health department in response to the disaster include expenses for purchasing medicines, postmortem services, and medical waste management.

The total damage to institutions and assets in the food and nutrition security sector is estimated at INR 1.08 Cr, with INR 0.29 Cr. attributed to damages and INR 0.79 Cr. to losses.

Apart from the re-installation of all services enjoyed by the affected community, the township should scale up the services in terms of quality and quantity. An evening clinic, an Ayurveda dispensary, a fitness centre, a karunya medical shop and a palliative care centre are included. To address the challenges of the affected population and the district, a tertiary mental health centre and capacity building for disaster risk reduction were also proposed.The trauma care/emergency services in the Government Medical College should be state of the art and there should be a dedicated tertiary mental health centre in the district.

The total reconstruction and recovery cost is projected to be INR 76.813 Crs. with the reconstruction component estimated to be INR 33.6 Cr and INR 43.213 Cr for the recovery component.

Psychosocial Wellbeing

The landslide had a devastating impact on the mental health of the local population. Many individuals who narrowly escaped the disaster experienced significant psychological distress, which may continue to affect their daily lives. Of the 1231 individuals assessed, 35% have reported sleep disturbances among other psychological symptoms.
Therefore, it is imperative to formulate a recovery plan to incorporate short, medium, and long-term interventions, recognizing the intangible nature of mental health and the unique coping mechanisms individuals employ in the aftermath of a disaster.Therefore, the total recovery cost of INR 2.3 Cr includes provisions for establishing a mobile psychiatry unit, a mental health clinic, ‘kuttiyidams’ in schools and PSS aid to vulnerable communities.

INFRASTRUCTURE SECTOR

Drinking Water and Sanitation

The landslide event caused extensive damage to the water supply and sanitation infrastructure across Chooralmala, Mundakkai, and Punchirimattom. A total of 140 open wells including the pump sets were damaged, with 60 in Ward 10, 30 in Ward 11, and 50 in Ward 12. Additionally, 10 bore wells were affected, including the pump sets, with 6 in Ward 11 and 4 in Ward 12.

Out of the three rural water supply schemes, two were fully damaged, and the one remaining scheme, though unaffected, is no longer usable, including its pump sets and pump houses. Furthermore, gravity-controlled pipelines spanning nearly 42.8 km were damaged, and 10 community toilets were completely destroyed.

The total financial impact amounts to a damage of INR 3.74 Cr. The estimated cost for reconstruction, considering a new township with modern drink-ing water and sanitation facilities is INR 33.5 Cr. Additionally, INR 5 Cr is proposed for train-ing workshops and capacity building. The total cost of reconstruction and recovery combined is INR 38.5 Cr.

Irrigation

Before the landslide, the total area of the river and embankment was around 11 hectares. Dur-ing the landslide, the total area of the river and eroded embankment became around 75 hec-tares. The landslide debris, which includes silt, large boulders, uprooted trees and building de-bris, has caused a reduction in the capacity of the stream and altered its course.

The damages to irrigation structures and equipment are estimated to be INR 0.48 Cr. The economic losses on irrigation tourism add up to INR 0.55 Cr. The overall damage and loss estimate totals INR 1.03 Cr.

The reconstruction activities include setting up a Community Micro Irrigation Project, Contour Terracing, and Water Conservation measures. The total reconstruction cost is projected to be INR 34.62 Cr. The recovery measures include the installation of river gauges, procuring flood modelling software and providing training of personnel in operation and simulation respectively.

The cost of recovery is estimated to be at INR 2.62 Cr. The overall reconstruction and recovery cost is INR 36.62 Cr.

Roads and Bridges

A total of 13.1 km of rural roads, 1 km of state highway, 1 pedestrian bridge and 3 road bridges over rivers were washed away along with 7 culverts which were fully damaged, thus bringing the total damage cost to INR 28.41 Cr. Additionally, the cost of constructing a temporary Bailey bridge and deployment of additional machinery and temporary setups made for the removal of debris is accounted for in the loss estimate amounting to INR 2 Cr. The total damage and loss are estimated to be INR 30.41 Cr.

The overall reconstruction and recovery cost is projected to be INR 267.62 Cr. The reconstruction measures include rebuilding damaged roads and constructing a helipad for emergency evacuation in Chooralmala and would include building resilient roads, bridges and supporting NMT infrastructure in the township.

The total reconstruction cost amounts to INR 260.12 Cr. Detailed investigations for new bridges, landslide hazards, weak and old bridge inventory, condition survey and resilience audit are considered under recovery measures totalling INR 7.5 Cr.

Power

The landslide impacted 1057 consumers forming 63% of the total 1658 consumers under

KSEB in the Meppadi Grama Panchayat. The total amount for damages is calculated to INR 9.16 Cr which includes damages to the structures, transformers, conductors and civil structures of KSEB Ltd. It also factors temporary connections, vehicle movement for cleaning up the debris, manpower for reconstruction, foregone income and other unexpected expenses.

The reconstruction cost amounts to INR 17.31 Cr, of which INR 4.71 Cr would be expended in the first phase for repairing and upgrading existing transformers, overhead lines, and consumer connections and INR 12.6 Cr for converting the 11 KV overhead line from Kothumunda to Chooralmala (17 km) to an underground cable system.

PRODUCTIVE SECTOR

Agriculture and Horticulture

In the agriculture and horticulture sub-sector, a total damage of INR 24.98 Cr is incurred. The damage to perennial crops (Cardamom, Black Pepper, Tea, Coffee, Nutmeg, Coconut, Arecanut, Jack, Mango and other fruit plants) was estimated to be INR 21.88 Cr. In contrast, annual crops (such as bananas, ginger, tubers, and vegetables) experienced damage amounting to INR 2.38 Cr. The damage to the farm equipment, pump sets and machinery is estimated to be INR 0.7275 Cr. The total economic loss is estimated to be INR 170.86 Cr, including INR 151.84 Cr worth of crop loss, INR 0.62 Cr for loss of stored agricultural products and INR 18.4 Cr for the loss of livelihood of estate workers. The combined damage and loss estimate is INR 195.85 Cr.

The total reconstruction cost is estimated to be INR 66 Cr across three wards, including measures to support homestead cultivation, nursery preparation and poly house among others. The total recovery cost comes up to INR 62.23 Cr. Under this, formation of farmer interest groups and business support can be established for all three wards amounting to INR 10.07 Cr. Additional recovery measures include compensation for crop loss at INR 24.26 Cr, compensation for land at INR 26.08 Cr and reclamation of land at INR 1.81 Cr. The combined reconstruction and recovery cost is estimated at INR 128.23 Cr.

Animal Husbandry and Livestock

The landslide caused significant losses in the animal husbandry sector, resulting in the loss of 226 cows, 165 goats, 12 buffaloes, 26 rabbits, and 1,032 poultry birds. These losses have had a profound impact on the local farming community, severely disrupting their livelihoods and income. The estimated damages and replacement costs for livestock were INR 2.68 crores, while the economic losses from the disruption of milk production, meat supply, and other live-stock products amounted to INR 8.54 crores. Total damage and loss are estimated to be INR 11.22 Cr.

The total recovery and reconstruction cost is estimated at INR 25.99 Cr. The cost of reconstruc-tion measures is expected to be INR 6.5 Cr, including the cost of setting up a veterinary hospi-tal, feed storage barns and mechanisation of dairy farming. The recovery plan will focus on replacing livestock and strengthening resilience to help the communities rebuild their livelihoods at a cost of INR 19.49 Cr.

Tourism

Wayanad is a district with a large area of forest and plantations. With varying climatic parame-ters, tourism and allied activities determine the growth of the local economy. The landslide-affected area was a favourite destination of the tourists encompassing mountain streams, planta-tions and waterfalls. 75 hotels or resorts and 21 homestays which generated around 40 crores annually as revenue were damaged in the disaster. This event affected the tourism industry across the district, impacting homestays, resorts, restaurants, transportation, adventure tourism ventures etc.

Loss estimated as part of the total shutdown of tourism activities and allied tourism dependent processes is anticipated to be INR 414.93 Cr. The reconstruction activities are being envisaged for an estimated amount of INR 22.25 Cr including the creation of common tourism facility centres and structural enhancement of 250 households in creating homestays as a livelihood option. As part of rejuvenating tourism activities across Wayanad, a mass media campaign along with the provision of enhancement of the facilities is planned as recovery for an amount of INR 3.43 Cr.

Thus, an amount of INR 25.68 Cr is budgeted for the recovery and reconstruction activities

against the anticipated revenue loss and damages. The disaster highlights the need for a balanced approach to development in Wayanad, where economic growth through tourism must be weighed against the ecological and social risks posed by the rampant development in vulnerable areas.

MSME

The Meppadi landslide impacted 84 MSME units, including 12 manufacturing, 25 services and 47 trade, causing an estimated combined damage and loss of INR 36.11 Cr and 222 jobs. INR 12.36 Cr was derived as damage cost to tangible assets excluding buildings, INR 15.16 Cr as wage loss for 3 years, INR 3.48 Cr as loss in building advance and rent and INR 5.1 Cr as loan from banks.

Reconstruction measures including building industrial units and setting up Craft Village add up to INR 16.66 Cr. Procuring machinery and equipment for commercial, industrial and household units, capacity building programs and pooled funds are accounted for in the recovery estimate of INR 48 Cr.

The overall cost estimate for reconstruction and recovery is INR 64.66 Cr.

CROSS-CUTTING

Disaster Risk Reduction

DRR measures cut across many sectors requiring meaningful partnerships and collaboration for its effectiveness. The interventions for developing DRR have been categorised into structural and non-structural initiatives.

The structural interventions or reconstruction measures are estimated at INR 238.996 Cr., including INR 217 Cr. for river training works to reduce risk, INR 3.006 Cr. for emergency power and solar lighting solutions and INR 18.99 Cr. for strengthening emergency operation and infrastructure.

A sum of INR 32.814 Cr. has been earmarked for recovery measures including community engagement (INR 2.115 Cr.), EWS (INR 3.516 Cr.), information communication (INR 1.65 Cr.) emergency response planning (INR 0.51 Cr.) and capacity building initiatives (INR 25.02 Cr.). The total reconstruction and recovery cost is estimated to be INR 271.81 Cr.

Forest and Environment

The landslide severely impacted a vested forest area in the Punnappuzha region. In the upper reaches, a significant 19 hectares of pristine tropical evergreen forest was completely destroyed. In the lower reaches, below Mundakkai, another 5.16 hectares of forest was lost. The damage extended further downstream, from Chooralmala to Soochippara waterfalls, resulting in substantial forest loss.

The total forest area affected by the landslide is estimated at 80 hectares. According to the Net Present Value (NPV) guidelines for forest diversion, the economic loss due to the lost forest area is assessed at INR 12.77 crores.However, this figure significantly underestimates the actual ecological value, considering ecosystem services, biodiversity, and the area's aesthetic appeal for tourism.

The landslide resulted in a devastating loss of 37.44 lakh tonnes of soil, including precious topsoil. While it's difficult to quantify the economic value of this soil loss and the compromised environmental services, the ecological damage is undeniable.

To address the aftermath, a comprehensive reconstruction plan has been proposed. This includes a significant investment of INR 7.354 crore for waste management infrastructure in the new township. Additionally, INR 4.33 crore is allocated for crucial soil and forest restoration efforts, involving reforestation and soil stabilization.The total estimated cost for reconstruction and recovery measures amounts to INR 11.684 crore.

Social Inclusion

The assessment identifies several vulnerable groups that require specialized attention, including - persons with disabilities (PwD), transgender individuals, elderly individuals (elderly-only households), women (women-only households), children (orphans, semi-orphans, and children-only households), migrants and indigenous communities. Assessing and acknowledging the needs of these vulnerable groups would promote an inclusive recovery plan.

The estimated total amount of INR 7.23 Cr. highlights the urgent need for comprehensive and inclusive recovery efforts to address the specific needs of these marginalized populations effectively.

The breakdown of recovery costs across different groups is such that INR 3.6 Cr is allotted for children, INR 0.84 Cr for senior citizens, INR 0.462 Cr for PwD, INR 0.815 Cr for women, INR 0.64 Cr for indigenous community, INR 0.411 Cr for transgenders and INR 0.459 Cr for migrants.

FINANCE AND INSURANCE

In any disaster, the financial effects extend beyond the immediate victims, spreading to influence connected businesses and services as well. The Meppadi landslide has led to direct revenue losses considering various loan products offered by 17 banks. This is accounted for in the loss estimate of INR 18.835 Cr.

Additionally, it would be prudent to set up a mechanism for Disaster Risk Finance to create a corpus fund for the state to cope with future catastrophes.

The interest rate on the fund is expected to be 8%, compounding monthly over 5 years. This recovery measure is estimated to be INR 50 Cr.

INTANGIBLE IMPACT

Based on the lessons learnt during the 2024 Meppadi landslide in Wayanad, the Kerala State Disaster Management Authority (KSDMA) has developed a comprehensive Socio-Environmental Loss Framework, to assist the PDNA in assessing the intangible losses from the landslide.

The landslide in Wayanad has had a profound impact on both the social and environmental fabric of the community. This disruption has led to intangible losses with long-term implications for human well-being and environmental health. The community's social cohesion, psychological well-being, and economic stability have been significantly affected. Additionally, the landslide has caused environmental damage, including habitat destruction, soil erosion, and increased vulnerability to climate change. These intangible impacts, while often overlooked, are crucial to consider for a comprehensive recovery plan.

> *During the Post-Disaster Needs Assessment (PDNA) exercise, the initially documented figures recorded 251 deaths and 47 missing persons. However, following the finalization and public release of the document, results from DNA analysis and the retrieval of body parts revised the total figures to 266 deaths and 32 missing persons. But in this PDNA, the sectors based their assessments and analyses on the initially reported data.*

THE TOWNSHIP

Build Back Better: Concept for a Resilient Township

The catastrophic landslide in Chooralmala, Wayanad has underscored the urgent need for a sustainable and resilient urban development model. The disaster caused extensive loss of life and infrastructure, highlighting the vulnerabilities in the region's current settlement pattern. The concept for the new township shall include and revolve around addressing the issues of Climate change, social inclusivity, vulnerability of the existing ecosystem which will help in developing a sustainable and resilient township.

Major considerations include:

- 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 residents in the planning and rebuilding process, ensuring inclusivity and a sense of ownership.
- Sustainable Development Goals Alignment: Ensure that the townships 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. For the proposed township there are 4 major categories of residents/ users:

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

The proposed township is planned to be developed at two identified locations:

1. **Elston Estate, Kalpetta Municipality**: It is situated in Kalpetta Village, within the Kalpetta municipality and Vythiri Taluk, in the Wayanad district of Kerala, India. This land has a total area of around 78.66 hectares.
2. **Nedumbala Estate**: It is situated in Kottappadi Village within the Meppadi grama panchayat and Vythiri Taluk, in the Wayanad district of Kerala, India. This land has a total area of around 65.4 hectares.

It is estimated that around 950 to 1000 families may be accommodated in the both sites together.

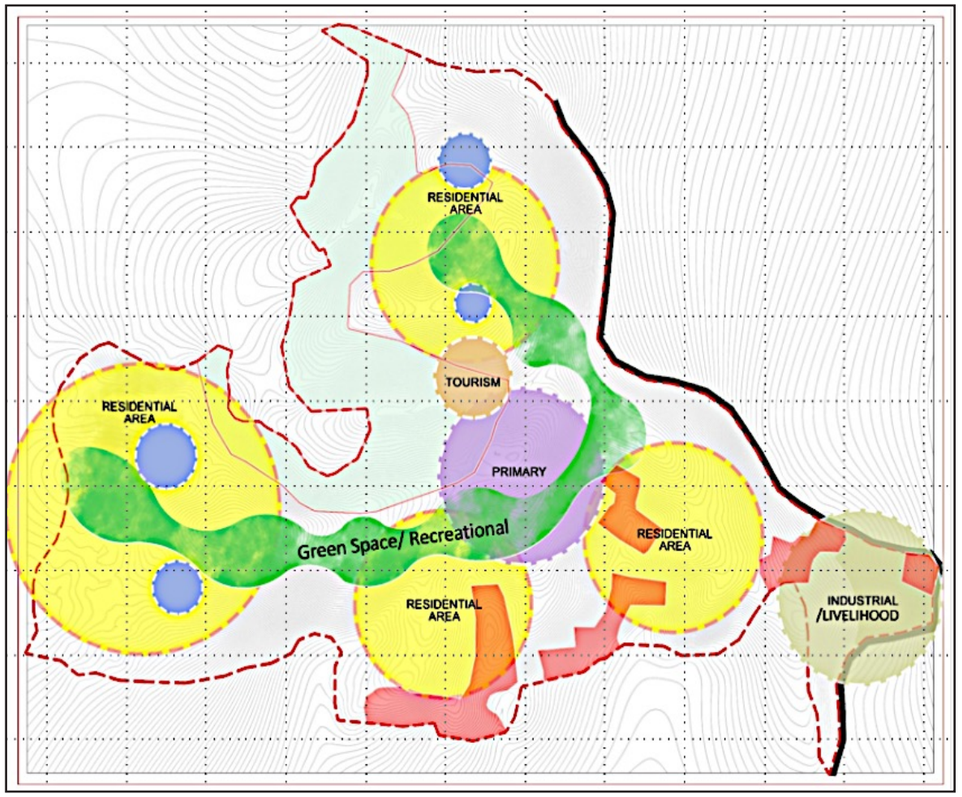
The major components of the proposed township are given in a brief below:

Settlement layout

The settlement layout shall be developed taking into consideration the existing contours and hilly terrain of the area. The steeper slopes and vulnerable areas in the site have not been utilized for development and are classified as buffer areas to minimize any kind of ecological disaster.

The site layout and zoning shall consider a decentralized approach with the residential clusters themselves having the basic facilities to cater to day-to-day needs. Large recreational areas are also proposed in the township.

Figure 0-1: *Settlement layout*



In addition to the residential areas, the township shall also have commercial spaces, market spaces, community centres, health centres and hospitals, Anganwadi, and livelihood opportunities among others which shall aid in the holistic rehabilitation of those displaced by the landslide.

The proposed township envisages the development of a community which shall aid in the healing process of those affected by the landslide. The township shall seek to recreate and facilitate a sense of ownership and belonging.The township will foster neighbourhoods with an active mix of recreational, community and other spaces rather than pure residential spaces.

A schematic representation of the proposed zoning in the site is given in the image *(Above)*.

Housing

The township shall adopt resilient and incremental housing approaches given its unique environmental, social, and economic context. There shall be provisions in each housing unit to allow for incremental methods of development for future expansions and customizations. The residential areas are designed to provide opportunities for community living as well as easy access to facilities.

It is proposed that while the residences are 1,000 sq. ft. in 5 cents of land, options for additional expansion to facilitate livelihood oppor-

Figure 0-2: *Livelihood Opportunities for the Township*

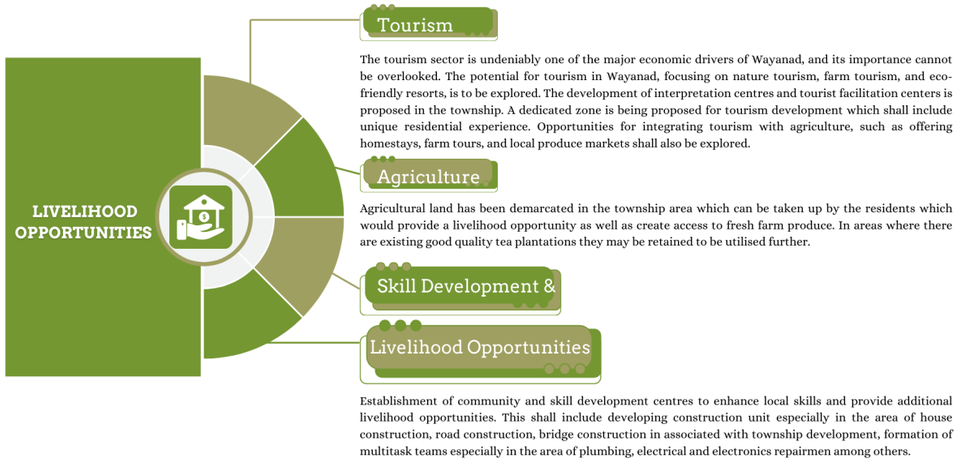
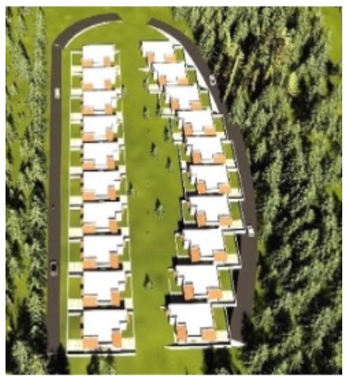


Figure 0-3: *Housing as cluster (left), at different levels connected by plazas(right)*





tunities such as homestays will be incorporated into the design. The design of the houses also shall be responsive to the varying terrains, such as stilt housing or split-level houses to minimize the disturbance of the natural slope and terrain. Residential clusters of around 15 to 20 Household with a common area are also being explored as an option in areas with relatively less gradient. In other areas, houses at different levels shall be connected through steps which can also act as plazas and intermittent spaces.

A schematic representation of both is given above .

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.

VILANGAD LANDSLIDE

This PDNA also includes a dedicated chapter analyzing the loss, damage, and recovery estimates associated with the Vilangad landslide. On August 31st, the PDNA central team conducted a site visit to assess the affected area.

On July 30, 2024, Vilangad experienced a series of landslides caused by continuous heavy rainfall and strong winds.The primary landslide occurred in the Kunjom forest area of Wayanad at around 12:50 A.M. This triggered a sudden rise in the water level of the Vilangadu river, causing the accumulation of water and debris. Seven houses near the Panom KSEB micro-hydel project were isolated due to the blockage of water flow, creating severe disruptions in the area.

At 01:15 A.M., a second landslide occurred at Adichippara hill near Nanjacheeli. This landslide formed a deep gorge, further obstructing stream flow and causing significant damage to the surrounding environment. The debris blocked critical water pathways, and over 70 landslides were reported in the nearby areas, including Panniyeri, Malayangadu, Kambilippara, Panom, and Kuttaloor.

It is the heavy rainfall and steep slopes triggered multiple landslides in the area. Despite the extensive damage, the relatively low population density in these high-risk zones, coupled with timely evacuation efforts, mitigated the loss of human life.

The residents, alerted through the LSG WhatsApp group and other information channels, voluntarily relocated to safer areas, including relatives' homes and Panchayat relief camps. The existence of a detailed disaster management plan for Vanimel Grama Panchayat further enhanced the preparedness and response efforts. Unfortunately, one life was lost in the incident.

Figure 0-4: *Meppadi Landslide - PDNA Process*

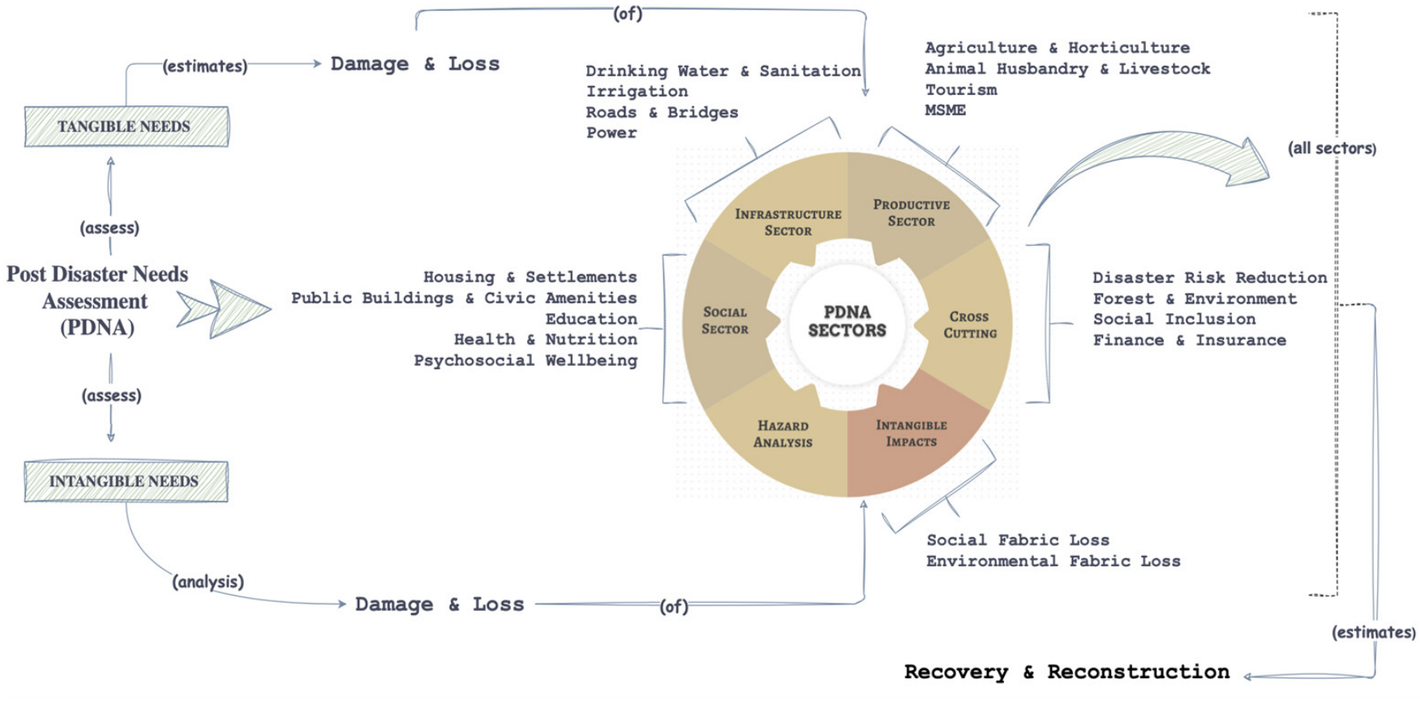


Table 0-1: *Summary - PDNA - Meppadi Landslide - 2024*

Summary - PDNA- Meppadi Landslide - 2024								
Sector			Damage and Loss (INR Crores)			Recovery and Reconstruction (INR Crores)		
Sl. No.	Sector	Sub-Sector	Damage Estimate	Loss Estimate	Total Damage and Loss Estimate	Reconstruction Estimate	Recovery Estimate	Total Recovery and Reconstruction Estimate
1	Social	Housing & Settlements	227.37		227.37	1106.85	6.4	1113.25
2	Social	Public, Community and Commercial Infrastructure	8.1		8.1	43.07	17.941	61.011
3	Social	Education	9.09		9.09	15.975	6.35	22.325
4	Social	Health and Nutrition	0.29	0.79	1.08	33.6	43.213	76.813
5	Social	Psycho-Social Well Being					2.3	2.3
6	Infrastructure	Drinking Water and Sanitation	3.74		3.74	33.5	5	38.5
7	Infrastructure	Irrigation	0.48	0.55	1.03	34	2.62	36.62
8	Infrastructure	Roads and Bridges	28.41	2	30.41	260.12	7.5	267.62
9	Infrastructure	Power		9.16	9.16	17.31		17.31

Summary - PDNA- Meppadi Landslide - 2024								
Sector			Damage and Loss (INR Crores)			Recovery and Reconstruction (INR Crores)		
Sl. No.	Sector	Sub-Sector	Damage Estimate	Loss Estimate	Total Damage and Loss Estimate	Reconstruction Estimate	Recovery Estimate	Total Recovery and Reconstruction Estimate
10	Productive	Agriculture and Horticulture	24.9875	170.86	195.8475	66	62.23	128.23
11	Productive	Animal Husbandry and Livestock	2.68	8.54	11.22	6.5	19.49	25.99
12	Productive	Tourism		414.93	414.93	22.25	3.43	25.68
13	Productive	MSME	12.36	23.75	36.11	16.66	48	64.66
14	Cross Cutting	Disaster Risk Reduction				238.996	32.814	271.81
15	Cross Cutting	Forest & Environment		12.77	12.77*	7.354	4.33	11.684
16	Cross Cutting	Social Inclusion					7.23	7.23
17	Cross Cutting	Finance and Insurance		18.835	18.835		50	50
Total Cost Estimate			**317.5075**	**662.185**	**979.6925**	**1902.185**	**318.848**	**2221.033**
Vilangad Landslide (Total Damage, Loss, Recovery Estimate)			**98.106**					

Only the loss of Forest is estimated

Financing for Recovery & Reconstruction

The aftermath of Meppadi landslide necessitates significant funding for recovery and reconstruction efforts for restoring normalcy and building resilience. The state government has estimated a funding requirement of INR 2,221.033 Cr. to support these critical efforts.

The following are a comprehensive range of possible funding mechanisms and options, to address immediate needs and long-term goals. That identifies key funding avenues that the state government can leverage to mobilize the necessary resource.

1. **Recovery and Reconstruction Funding window of National Disaster Response Fund (NDRF):**

National Disaster Response Fund is the vital mechanism to provide financial assistance for post-disaster recovery and reconstruction efforts. The NDRF primarily focusses on immediate relief but also allows for the long-term recovery and reconstruction activities. It specifically supports rebuilding essential infrastructure and restoring public services disrupted by the disaster.

The 15th Finance commission has allocated INR 1,000 to NDRF for the resettlement of people affected by erosion. The policy for the resettlement of displaced people includes non-structural solutions such as providing livelihood opportunities and rehabilitation. The state government can seek the amount of the livelihood recovery of the affected people.

2. Mitigation measure to prevent erosion under NDMF:

The National Disaster Mitigation Fund (NDMF), also constituted under the 15th Finance Commission, shall be used for the local level and community -based interventions, which reduce the risks and promote environmentally friendly settlements and livelihood practices. The mitigation measure includes both structural measures (e.g., constructing flood barriers and dikes) and non-structural measures (e.g., implementing building codes, land-use zoning, and forest management practices). By enhancing community resilience, and funds from this source can be directed toward erosion prevention and mitigation projects.

3. National Landslide Risk Mitigation Scheme (LRMS):

The National Landslide Risk Mitigation Scheme (LRMS), administered by the National Disaster Management Authority (NDMA), can provide financial assistance to states grappling with landslide-prone regions. The LRMS prioritizes a proactive approach to disaster prevention, encompassing research and development for landslide monitoring, early warning systems, and capacity-building initiatives. The state government can leverage the LRMS to secure funding for implementing effective landslide mitigation strategies in vulnerable areas.

4. Prime Ministers' National Relief Fund:

Prime Minister's National Relief Fund established with public contributions can be utilized to render immediate relief to families of those killed in natural calamities like floods, cyclones, etc. The fund is fully collected from the public and has no budgetary allocation from the government. This fund is particularly valuable for offering emergency financial assistance to families who have lost their homes or loved ones in the disaster. Since the PMNRF does not rely on government budget allocations, it can be a flexible and immediate source of funds for relief operations.

5. Prime Ministers' Citizen Assistance and Relief in Emergency Situations Fund:

The PM CARES Fund, registered as a public charitable trust, is another critical source of funding for relief and assistance in public health emergencies, natural calamities, and man-made disasters. The state government can request funds from PM CARES to support recovery and reconstruction efforts, including health-related interventions, public infrastructure rehabilitation, and assistance for affected families.

6. Mahatma Gandhi National Rural Employment Guarantee Scheme:

The Scheme can provide additional financial resources for livelihood recovery and infrastructure development in rural areas. The scheme promotes a bottom-up approach to planning and execution, empowering local communities to participate in rebuilding efforts. Funds from MGNREGS can be used for rebuilding public infrastructure, soil conservation, and other community-oriented reconstruction projects.

7. Flexi funds in centrally sponsored schemes (up to 10%):

The State government can consider the possibility of acquiring Flexi-fund of the budget of Centrally sponsored schemes (CSS).Since, CSS offer flexibility to state governments through the flexi-fund mechanism, which allows states to use up to 10% of the funds allocated to CSS for recovery and restoration activities. This flexibility ensures that the state can reallocate resources to meet local needs during times of natural calamities, focusing on mitigation and reconstruction efforts in sectors covered by CSS programs.

8. State Budget Allocations and Restructuring of Funds:

The state government can restructure its budget allocations to prioritize recovery and reconstruction activities. By focusing on disaster preparedness, mitigation, and resilience-building, the state can reduce future disaster risks and financial losses. Restructuring funds to emphasize long-term recovery, rather than short-term relief, will help create more sustainable communities and prevent recurrent disasters.

9. **Chief Ministers' Distress Relief Fund:**

The CMDRF is a public fund constituted to provide relief in cases of severe privation caused by disasters such as floods, cyclones, and sea erosion. Contributions to the fund are made by individuals, corporations, and other entities. The CMDRF can be used to support families affected by disasters, provide immediate assistance, and help rebuild critical infrastructure in the state.

10. Corporate Social Responsibility Funds (CSR):

CSR mandates that companies allocate a minimum of 2% of their net profit over the preceding three years for social welfare initiatives. CSR funds can be a significant resource for recovery and reconstruction efforts. The state government can collaborate with the private sector to direct CSR funds toward disaster recovery initiatives, including infrastructure rebuilding, health interventions, and livelihood restoration.

HAZARD ANALYSIS

01



Hazard Analysis – An overview

1.1. Profile of the State

Kerala, a state in southern India, is bordered by the Arabian Sea to the west and the Western Ghats to the east. It shares borders with Karnataka to the north and Tamil Nadu to the east. Covering an area of approximately 38,863 square kilometers, Kerala boasts a diverse landscape featuring the Western Ghats, lush valleys, serene backwaters, and a 590-kilometer-long coastline. Kerala's strategic location as a gateway to the southwest monsoon and its significant role in international maritime trade through major ports like Kochi further enhance its importance.

Demographically, Kerala has a population of over 33 million, with high literacy rates of around 96.2%, the highest in India. The state boasts a balanced male-to-female ratio and a robust healthcare system, contributing to high life expectancy and low infant mortality rates. The state is known for its religious diversity, with Hinduism, Islam, and Christianity being the major religions, coexisting harmoniously.

Economically, Kerala's resilience is evident in its diverse economic drivers. The state's economy is primarily fuelled by agriculture, remittance, tourism, and a flourishing IT sector. Major agricultural products, such as rubber, tea, coffee, spices, and coconuts, contribute significantly to the state's economy. Kerala also benefits from remittances from a large expatriate community, particularly from the Gulf countries. With its scenic landscapes, backwaters,

and cultural festivals, the tourism industry plays a pivotal role in Kerala's socio-economic fabric, attracting domestic and international tourists.

Kerala's unwavering commitment to social welfare, education, and healthcare has positioned it as a model for human development in India and inspired other regions. However, the state has challenges, including unemployment, especially among educated youth, and environmental concerns from population pressure and extreme hydro-meteorological hazards. These challenges necessitate sustainable development and disaster management strategies, but Kerala's achievements are a beacon of hope for the future.

1.2. Disaster Profile of the State

Kerala is highly vulnerable to a wide array of disasters, making it a multi-hazard-prone state [***Figure 1-1***]. The recurrent nature of these disasters results in the loss of life, livelihood, and property (both public and private) while also disrupting economic activities and causing immense hardship to the affected populations. The state's exposure to heavy rainfall and flooding during the southwest monsoon often leads to significant damage. In addition, drought conditions have become more frequent during the pre-monsoon period and sometimes occur when either the southwest or northeast monsoon fails. Coastal erosion along the shoreline is a severe issue, frequently requiring the evacuation and rehabilitation of coastal communities. Moreover, biological disasters, such as epidemics and pest infestations, are rising.

Kerala also faces a high incidence of road and rail accidents, along with manmade disasters, lightning strikes, and boat capsizing. In the hilly regions, landslides or landslips pose significant hazards.

The 2004 tsunami added another dimension to the state's disaster scenario, as many low-lying and midland areas are situated at altitudes of only 4-6 meters.

Cyclones are another threat, as high winds caused by the westward movement of cyclonic storms crossing the Tamil Nadu coast impact Kerala.Additionally, the state is in Earthquake Zone III, making it vulnerable to earthquakes of up to magnitude 6.5. Potential disasters like chemical and industrial accidents and dam bursts also present significant risks. The looming threat of global warming has exacerbated these vulnerabilities by altering climatic patterns, increasing rainfall variability, and contributing to rising sea levels. Rapid urbanization and waste management issues further complicate the situation.

Given these challenges, the Government of Kerala has recognized the need for a proactive, comprehensive, and sustained approach to disaster management to mitigate the detrimental effects on the state's socio-economic development. In alignment with this, the Kerala State Action Plan on Climate Change 2.0 (2023–2030) has emphasized that "extremely heavy rainfall events are projected to increase in all districts under both Representative Concentration Pathway (RCP 4.5 and RCP 8.5) scenarios compared to the historical period." The plan also notes that these extreme rainfall events' magnitude, frequency, and timing are expected to change. This trend was clearly seen in the landslide and debris flow event in Meppadi Grama Panchayat, Wayanad, on July 30, 2024, which can largely be attributed to climate change and the unprecedented rainfall intensity in the region.

Over 48 hours, the area received 572.8 mm of rain, with 372.6 mm falling just hours before the disaster (Kalladi Rain Gauge of Irrigation Design & Research Board).

Such extreme weather patterns are increasingly tied to global warming, which disrupts rainfall distribution and intensity, as outlined by the Intergovernmental Panel on Climate Change (IPCC) and the SAPCC. Rising sea temperatures in the Arabian Sea have intensified monsoonal rains, increasing the vulnerability of Wayanad's already landslide-prone terrain.

Although local factors may influence the region's susceptibility, the overarching impact of climate change is evident, as shown by the increasing frequency and severity of these events. The disaster in Meppadi Grama Panchayat of Wayanad districts is a stark reminder of the local consequences of global climate dynamics.

1.3. Landslides in Kerala

As per the Kerala State Disaster Management Plan 2016, Kerala faces 39 specific hazards, ranging from natural to anthropogenic threats.

Table 1-1: *Recent landslides that occurred in Kerala*

Landslide	District	Year	Fatalities	Notable
Multiple Events	Various Districts	2018	155	The highest widespread rainfall event that the state faced in 100 years (Annual Report of Kerala State Disaster Management Authority 2018-19)
Kavalappara	Malappuram	2019	69	Buried entire villages, extensive damage to infrastructure
Puthumala	Wayanad	2019	17	Substantial damage and loss
Pettimudi	Idukki	2020	70	Due to heavy rainfall (616 mm in 24 h)
Koottickal	Kottayam	2021	13	Widespread destruction and loss of life
Meppadi	Wayanad	2024	251 (confirmed) + 47 (missing)	Landslides, consequent landslide dams and resultant debris flow

The disastrous consequences of numerous hazards frequently ravage the state.

Hence, it is a multi-hazard prone State [***Figure 1-1***], with landslides being a significant concern due to its rugged terrain and heavy monsoon rains [***Figure 1-2***]. The state's susceptibility to landslides is particularly evident in its Western Ghats region, where steep slopes and saturated soil conditions create ideal conditions for such events. In Kerala, each district faces unique challenges related to landslide disasters, significantly impacting local communities and infrastructure. The Meppadi Landslide event follows a series of similar disasters in Kerala, pointing to an alarming trend of escalating climate-related hazards [***Table 1-1***].

1.4. Landslide risk reduction efforts of Kerala

1. The State, vide GO (Ms) No. 68/2011/DMD dated 8-2-2011, constituted the State Level Crisis Management Group for Natural Disasters.

2. The State, vide GO (Rt) No. 542/14/ID dated 26-5-2014 constituted the State Level and District Crisis Management Group for mitigating disasters in mines.

3. Village wise hazard susceptibility prepared based on the landslide hazard susceptibility map prepared by the Centre for Earth Science Studies in 2010 was published as an atlas in the name Hazard Susceptibility Assessment Kerala 2014, which is accessible from https://shorturl.at/5Hrbb.

4. Under Section 30 (2) (xxiii) of the Disaster Management Act, 2005, it is the responsibility of the District Disaster Management Authority to "Examine the construction in any area in the district and, if it is of the opinion that the standards for the prevention of disaster or mitigation laid down for such construction is not being or has not been followed, may direct the concerned authority to take such action as may be necessary to secure compliance of such standards." Wayanad DDMA has issued such a detailed order vide Proceedings No. 2014/21178/12/H3 dated 30-6- 2015, and this Hon'ble Court had upheld the said order in WP (C) No. 24873 of 2015 (H) dated 3-11-2015 whereby based on the local vulnerabilities, the DDMA regulated the construction practices in the district.

   This Order is provided in the State Disaster Management Plan 2016 as Annexure 8 and is highlighted as a best practice for all DDMAs to follow in Section 3.21.1 of the State Disaster Management Plan 2016.

The specific statement in the State Disaster Management Plan 2016 is "An example of restrictions that could be imposed for construction in such high-hazard zones can be found in the Proceedings of the Chairman, DDMA, Wayanad No. 2014/21178/12/H3 dated 30-06-2015. Hon'ble High Court of Kerala upheld these proceedings excluding the 'retrospective effect' part of the proceedings in order WP (C) No. 24873 of 2015 (H) dated 3 November 2015." Thus, the DDMAs of Kerala are adequately guided by the State Disaster Management Plan 2016 with examples for undertaking such mitigation steps relating to construction in landslide-prone areas.

5. The State prepared and published the Orange Book of Disaster Management 1 – Standard Operating Procedures and Emergency Supports Functions Plan in 2015 (1st edition), which contains specific landslide response standard operating procedures (https://shorturl.at/IaaPhv).

6. The Kerala State Disaster Management Authority legalized and notified the landslide hazard zonation map prepared by CESS vide powers vested under Section 22 (2) (b) and Section 23 through the State Disaster Management Plan 2016. The State and District Plans were submitted to the Hon'ble Supreme Court in WP (C) No. 444 of 2014 with WP (C) No. 823 of 2013 dated 8-5-2017 in which the Hon'ble Supreme Court has directed that "we are of the opinion that there has been sufficient compliance with the provisions of the Act and it is not necessary for us to issue any particular directions."

7. Through the State Disaster Management Plan, Chapter 4 - Mainstreaming Disaster Management, the following are obligated upon the departments of the state:

It is directed under Section 22 (2) (h) of the DM Act, 2005 that:

a) No structural development plans in the State shall be approved without consideration of the hazard prone area maps published by SEOC.

b) All departments shall allocate 10% of their respective sectors' annual plan budget for disaster preparedness, response, recovery and mitigation.

c) It is often noticed that there are inadequate funds for retrofitting and maintnance of lifeline buildings. It shall be the responsibility of the respective department to apply science technology and engineering inputs to improve infrastructures, including dams and reservoirs, hospitals, schools and bridges in the State. Funds allocated under clause (2) may be utilized for this purpose.

d) It shall be the responsibility of the local self-governments to ensure that all private buildings in their jurisdiction are disaster resilient and have been constructed following all required safety considerations under Kerala Municipal Building Rules and Kerala Panchayat Building Rules.

8. Chapter 5 of the State Disaster Management Plan deals with the Responsibilities of Stakeholders 'Sections 38 and 39 of the DM Act, 2005, which enlists the responsibilities of the State Government and the Departments of the State Government. All departments shall ensure that their departmental disaster management plans are submitted to KSDMA for approval within 3 months of approval of this plan.' The roles and responsibilities of individual departments are well outlined in the State Disaster Management Plan.

Section 5.13 deals with the role of the Environment and Climate Change Department,

- Ensure that the Environment Relief Fund under Section 7A of the Public Liability Insurance Act, 1991 (amendment 1992) is created and that Section 11 of the Act is complied with.

- Promote climate risk insurance.

- Provide localised projections of the implications of climate change on rainfall, temperature, humidity, wind speed and wind direction.

- Ensure the implementation of the Kerala State Action Plan on Climate Change, 2014.

Section 5.14 deals with the role of SEIAA,

- Ensure that disaster management plans and hazard susceptibility maps are consulted and adequate risk reduction measures are incorporated into project proposals prior to issuing environmental clearance.

Section 3.21.1 deals with Landslide risk reduction and states that,

- Developmental activities in the high-hazard zones, as marked in the district wise landslide hazard susceptibility map, shall strictly be regulated and restricted.

- An example of restrictions that could be imposed for construction in such high-hazard zones can be found in the Proceedings of the Chairman, DDMA, Wayanad No. 2014/21178/12/H3 dated 30-06-2015. Hon'ble High Court of Kerala upheld these proceedings, excluding the 'retrospective effect' part of the proceedings in order WP (C) No. 24873 of 2015 (H) dated 3 November 2015.

- Landslide Standard Operating Procedure, as given in the Emergency Supports Functions Plan, 2015, shall be complied with:

- *The creation of rain pits on slopes greater than 20 degrees will increase the probability of landslides and, hence, shall be banned.*

- *In the high-hazard zones, quarry blasting increases the probability of triggering landslides. DDMAs of Kerala shall ensure that permission is not granted for quarry blasting in the landslide high-hazard zones as given in Hazard Susceptibility Assessment Kerala (HSAK), 2014. In moderate hazard zones, as given in HSAK, 2014, quarrying shall be permitted only after getting the approval of the district level crisis management committee for mining constituted vide G.O (Rt) No. 542/14/ID dated 26-05-2014.*

- *Quarry blasting shall temporarily be banned if there are two consecutive days of rainfall in the respective village until a completely rain free day occurs. Village Officers are specifically delegated to ensure the implementation of this. This shall be in effect throughout the monsoon season.*

These specific actions, as laid in the State Disaster Management Authority and the landslide hazard zonation, were upheld in the orders of this Hon'ble Court in WP (C) No. 4022 of 2017 dated 16-11-2018. These orders of the Hon'ble High Court prevented quarry blasting in high hazard zones.

9. To enable the public, the State Disaster Management Authority, for the first time in the country, has openly published all scientifically prepared hazard susceptibility maps in a format that could be used in any geographical information system. To identify the hazard susceptibility of a particular area, any individual can visit the website of KSDMA (https://sdma.kerala.gov.in/wp-content/uploads/2020/08/Landslide-1.rar) and download the Google Earth File given therein and use in free software such as Google Earth to examine the susceptibility of the plot/location under question by providing the Geocoordinates of the site/corners of the plot.

   These maps have been used since 2016 by environmentally conscious citizens in various public interest litigations that are settled under consideration of this Hon'ble Court. There is hardly any other State wherein citizens use a legally notified landslide hazard zonation map for defending public interest in disaster management and where the Hon'ble Court has taken cognizance of such a map and has defended its scientific and technical veracity in detail as given in Hon'ble Court in WP (C) No. 4022 of 2017 dated 16-11-2018. Professionals in disaster management highly appreciate this order of the Hon'ble High Court of Kerala.

10. KSDMA has also identified the road networks, schools, and hospitals susceptible to landslides and published as part of the State Disaster Management Plan for local governments and other concerned departments to ensure landslide risk reduction in their respective sectors as stipulated in Section 39 of the Disaster Management Act, 2005 - Responsibilities of departments of the State Government. These departments are also directed to prepare departmental disaster management plans and allocate

funding from their own resources for disaster risk reduction as laid in Section 39 of the Disaster Management Act, 2005. Templates and training for preparing departmental Disaster Management Plans were given to the Virtual Cadre officers in 15 departments and KSDMA is awaiting the Departmental Disaster Management Plans.

11. The State Disaster Management Authority, through the State Disaster Management Plan, not only identified risks but also succeeded in ensuring risk sensitive land use restrictions in the State, such as "No permission for blasting type quarrying in the high hazard zones of Kerala as per the State Disaster Management Plan 2016." WP (C) No. 4022 of 2017 upheld this decision, dated 16/11/2018. Vide Ltr. No. DM/546/2017 (1) dated 23-6-2017, the KSDMA requested the Principal Secretary, Industries to amend the Kerala Minor Mineral Concession Rules, 2015 in line with the Kerala State Disaster Management Plan 2016 whereby permission is not given to blasting type quarrying in the high hazard zones.The Government in Industries Department vide Ltr No. IND-A3/410/2019-IND dated 26-12-2019 informed that the Mining and Geology Department is not issuing quarrying permits/leases for mining granite rocks using explosives in high hazard zones as mapped in the landslide susceptibility maps and hence the KMMCR 2015 is not required to be amended as proposed by KSDMA."

12. Prevention of obstruction of streams and natural drains to avoid landslides and local flooding - based on the direction of this Hon'ble Court to KSDMA in WP(C) 36879/2016 and the direction of KSDMA to the Government, the Government has amended the Kerala Municipal/Panchayat building rules through S.R.O. No. 828/2019 dated 8-11-2019 and included Section 22 (4) "No construction shall be made to obstruct the natural drains and streams in a plot. Failure to comply with this instruction will invite penalization under Section 51 of the Disaster Management Act, 2005 (Central Act, 53 of 2005)."

    This is a significant legislative move in mainstreaming landslide risk reduction as natural and/or human induced obstruction of minor streams and construction in such streams and the flood plains of such streams are seen as the primary reason for catastrophic damage and loss of life due to landslides. Landslides once triggered follows these small streams which originates in hills slopes.

13. Vide G.O (Rt) No. 2204/2011/DMD, dated 08/04/2011 an Expert Technical Committee on Techno Legal Regime in Disaster Management was constituted by the Government to examine various requirements for disaster resilient construction and recommend amendments of Kerala Municipal Building Rules (KMBR) and Kerala Panchayat Building Rules (KPBR).

    The State Executive Committee of KSDMA examined the report and on 18/2/2016 in its meeting and issued the following decision: "The Committee, vide powers vested on it under Section 64 of the Disaster Management Act, 2005, decided to direct the Local Self Government Department to consider amending Kerala Municipal Building Rules and Kerala Panchayat Building Rules based on the findings of the Committee after further necessary consultations."

14. The Kerala State Disaster Management Authority conducted a specific one day awareness workshop on landslide and climate change in collaboration with the Geological Survey of India, the Government of India and the United Nations Development Programme and discussed in detail the landslide hazard zone maps of the State on 25/8/2014 as part of conducting stakeholder consultation for Disaster Management Plan Preparation (https://shorturl.at/s9kL7).

15. Even before the major floods of 2018 vide GO (Ms) No. 6/2018/DMD dated 2-06-2018, the State started a disaster vulnerability linked relocation scheme. Vide GO (Ms) No. 7/2018/DMD dated 21-06-2018 and GO (Ms) No. 25/2019/DMD dated 23-8-2019, the scheme was extended to other hazard prone areas of the State whereby if a land parcel with a house is identified by the competent technical authority such as, Geological Survey of India, Irrigation Department, Mining and Geology Department, Soil Conservation Department or such other technical departments or committee constituted by KSDMA or DDMA, as hazard prone and certified as not liveable, the legal owner of the house and land is eligible for INR 6 lakhs to purchase a minimum of 3 cents of safe land and he/she/they will be eligible for INR 4 lakhs to construct a new house. If one avails of this option, the beneficiary is no longer permitted to construct any building on his/her/their 'non-liveable land.'

16. Post Kerala Floods 2018, the Government directed the Geological Survey of India vide GO (Ms) No. 20/2018/DMD dated 7-9-2018 to map the landslides that occurred in 2018. Geological Survey of India, in priority, deployed ten teams, each with two geologists, to immediately survey the landslide sites and propose inhabitable sites so that the families dwelling there could be facilitated for relocation.

    In total 1626 landslides were investigated, and based on the site-specific investigations, GSI recommended that 689 dwelling units be relocated. The Government vide GO (Ms) No. 6/2019/DMD dated 27-2-2019 made the vulnerability linked relocation plan applicable to the dwelling units identified as vulnerable by the Geological Survey of India (GSI). Further, more Kerala faced severe landslides in 2019. A rapid assessment of the safety of areas affected by landslides/debris flows and the sites where radial cracks formed in the slopes due to aborted landslides was deemed necessary.

    Accordingly, officers of the Mining and Geology, Ground Water and Soil Conservation Departments were paired into 49 teams and trained by KSDMA with the assistance of landslide experts and the Geological Survey of India. Each team had one Geologist and a Soil Conservation Officer. The teams were deployed in 9 districts vide GO (Rt) No. 520/2019/DMD dated 19-8-2019. In total 719 sites were investigated. Based on the site-specific investigations, the teams recommended relocating dwelling units at 411 sites. The Government vide GO (Ms) No. 25/2019/DMD dated 23-8-2019 made the vulnerability linked relocation plan applicable to the dwelling units which were identified as vulnerable by these teams.

    This is India's only operational landslide vulnerability linked relocation plan wherein the beneficiary need not surrender their original land, and thereby the emotional barrier of having to abandon the land is overcome. Over 3000 individual families identified to be in vulnerable areas in the State have availed of this option and moved to safer locations. No forceful relocation is recommended and is not considered a best practice, particularly in light of human rights and shortage of land availability. The most recent Government Order in this regard is GO (Rt) No. 591/2024/DMD dated 9-8-2024, in which three families were provided with this scheme to relocate from vulnerable areas.

17. KSDMA in collaboration with UNDP, conducted a detailed consultation on "Developing appropriate technologies and strategies for housing in hilly terrains (Idukki and Wayanad)" at Kozhikode on 15-12-2018. Based on this consultation, KSDMA published a guideline called Handbook on Safe Construction Practices – Floods & Landslides (Malayalam) in 2019 (https://shorturl.at/TvJtt). KSDMA publishes guidelines under Section 18 (2) (d) of the Disaster Management Act, 2005.

18. Based on the recommendation of KSDMA vide Section 17 of the Disaster Management Act 2005, the Government vide GO (Rt) No. 644/2018/DMD dated 30-11-2018 constituted an expert advisory committee under Section 17 of the Disaster Management Act, 2005 to study the construction of houses in high hazard areas. The committee met on 26-11-2018 and recommended a checklist to the Government vide Ltr. No. DM/2586/2018/SDMA dated 11.12.2018 and 19.1.2019.

    It is expected that by following the checklist, the engineer of the concerned local self-government and the district geologist (representative) can identify whether a proposed site for construction is landslide susceptible and whether a building permit should be issued. The matter is under the consideration of the Government. This is a significant step in reducing long-term landslide risk if the government accepts and

approves it.

19. As stipulated in the State Disaster Management Plan under Section 23 (4) (d) of Disaster Management Act 2005 'The capacity-building and preparedness measures to be taken', based on the guidelines issued, KSDMA conducted the following training programmes for ensuring safe constructions, the reports of which may be found in https://sdma.kerala.gov.in/capacity-building/

- Orientation Seminar on Disaster Resilient Construction Practices for Registered Architects and Licensed Civil Engineers, 20 November 2019 at Thiruvananthapuram and 22 November 2019, at Kozhikode.

- Training of Trainers for Kerala State Nirmithi Kendra Trainers on Disaster Resilient Construction Technologies, 29- 31 October 2019.

- Training on Disaster Resilient Construction and Quality Monitoring for LIFE Mission Rebuild Hub Personnel, 17-19 November 2019, Thiruvananthapuram and 26-28 November 2019, Kozhikode.

- Workshop on Retrofitting and Plot-Specific Landslide Mitigation for LIFE Mission rebuild hub (Surakshitha Koodorukkum Keralam) engineers and LSGD engineers, 8-9 April 2019.

20. The State has trained and deployed 4500 Aapda Mitra volunteers across the State and aligned them to the Fire and Rescue Stations. They are trained in search and rescue operations and given a response kit and an insurance cover. Thus, the state has nurtured a first responder team from amongst the communities to respond to disasters.

21. Recognizing the imperative need for expertise tailored to these specific challenges, the Kerala State Disaster Management Authority (KSDMA) joined hands with the Norwegian Geotechnical Institute (NGI) to conduct an extensive 5-day workshop for building institutional capacities in key departments in the State in reducing risks through resilient infrastructure designs from 17-21 October 2023. This collaborative effort assembled a consortium of experts from NGI and KSDMA and participants representing various government organizations within Kerala (Report can be accessed here https://shorturl.at/JfPHt).

22. Ten facilitation centres were established and operated with the financial support of the UNDP Shelter Project in Kerala from November 2018 to June 2019 in Pathanamthitta, Idukki and Wayanad to provide technical assistance to multiple stakeholders involved in house reconstruction such as beneficiaries, masons, contractors etc. The activities of shelter hubs focused on promoting disaster resilient and sustainable construction practices through consultancy, outreach, advocacy, networking and resource mapping.

    With Habitat Technology Group as the implementing agency, within a period of eight months, shelter hubs a) Provided on-site technical assistance to 3597 flood affected house owners and oriented 934 masons (including 369 Kudumbashree women masons), 203 house owners, 60 contractors and 373 civil engineering diploma students in disaster resilient and sustainable construction practices. A report of the operations of Shelter Hubs may be found at https://sdma.kerala.gov.in/wp-content/uploads/2020/11/Report_Shelter-Hubs_UNDP.pdf.

23. KSDMA supported Christ College, Irringalakkuda, Thrissur to conduct a project titled 'Landslide susceptibility assessment and preparedness strategies, Thiruvambadi Grama Panchayat, Kozhikode District Kerala'. The project report received in 2019 may be found here (https://sdma.kerala.gov.in/wp-content/uploads/2020/11/KSDMA-REPORT.pdf). The report provided field-based clarity on various factors that need to be considered when preparing a residential policy in landslide susceptible areas.

24. The government of Kerala decided to prepare local disaster prevention strategies vide GO (Ms) No. 156/2019/LSGD dated 4-12-2019 and GO (Ms) No. 157/2019/LSGD dated 5-12-2019. Under the Rebuild

Table 1-2: *Landslide specific challenges, reasons for challenges and possible solutions recommended by the technical stakeholder workshop held on January 29-30, 2020*

Key Challenges	Reasons for Challenges	Possible Solutions
Landslides		
The Following Factors Pose Challenges: • Physiographic aspects • Anthropogenic activities • Vegetation • Settlements • Groundwater • Drainage choking • Housing and livelihoods • Early Warning	• Intense Rainfall And Precipitation • Land Use Change • Mono Cropping/ Cropping Pattern • Construction Of Structures (Modification Of Slopers) • Water Table Change • Blockage Of Natural Drainage	• Zonation of susceptible areas in cadastral level - high and medium • Clearance from the geologist to be made necessary for constructions. • Site specific consultation from the geologist before and after a landslide. • Relocation of people in vulnerable locations to stable locations. Clustered Village level settlements preferred. • Site specific actions to be taken on relocation during the recovery and rehabilitation stage. • Bring restriction on agricultural activities. Alternate agricultural activities. • Rainfall threshold forecasting • Building awareness at local level • Community based disaster management plans to be prepared. • Local community to be sensitized on natural indicators of hazards. • Interstate governance approach to be adopted in data sharing.

Kerala Development Programme, a project titled Nammal Namukkay (we for us) was launched to enable the Local Self Governments to mainstream disaster risk reduction in the development plans vide GO (Rt) No. 499/2019/P&EA dated 26.11.2019 and GO (Ms) No. 34/2019/P & EA dated 12.12.2019. Vide GO (Rt) No. 36/2020/P&EA dated 21.1.2020, the Government allocated INR. 1,72,28,840 for KSDMA for additional human resources and augmenting its facilities to implement the project. A detailed framework, template and guidelines were prepared and published by KSEOC and KILA for LSG DM Plan preparation with the approval of the Government vide GO (Ms) No. 14/2020/LSGD dated 14.1.2020, targeting the functionaries of the Local Self Governments. Virtual training was imparted.

In order to review the plans prepared by the local self-governments, 14 Local Self Government DM Plan Coordinators were posted in the District Planning Offices. Local Governments were given landslide susceptibility maps tailored to their administrative area for incorporation in these plans and to identify suitable mitigation measures. All local governments have completed the Local Disaster Management Plans, which are accessible here https://dmp.kila.ac.in/.

25. Vide Section 17 of the Disaster Management Act 2005, the Government constituted an advisory committee to examine various landslide related complaints and anomalies through GO (Rt) No. 256/2020/DMD dated 17-3-2020 (https://sdma.kerala.gov.in/wp-content/uploads/2019/12/GO-Advisory-Committee-Landslide.pdf). The committee has met more than 15 times and has investigated and provided technical recommendations to various landslide and quarrying related issues across the State, including in multiple cases that are under the consideration of the Hon'ble High Court.

26. To facilitate the Rebuild Kerala Development Programme – the Reconstruction Programme of the State, KSDMA organised a Technical Stakeholder Consultation – 'Nammal Namukkayi' – Rebuild Kerala Initiative, 29-30 January 2020 (https://shorturl.at/fJroz). The recommendations for this workshop were given to the RKI

Department for further action. The key challenges, reasons for problems and possible solutions for various hazards, including landslides were examined in the programme. The specific recommendations regarding landslides are given in [***Table 1-2***].

27. The most critical actions relevant to reducing risk in landslide prone areas are:

a) In May, urban and rural local governments start monsoon preparedness cleaning of storm water drains and rivulets.

b) Incident Response System (IRS) is notified in all districts and Taluks in the Orange Book and through follow-up orders of DDMAs, orders assigning responsibilities were issued. IRS is a national operational methodology for integrated operations of various departments for disaster response. Trainings were given to those individuals in the Incident Response Teams. An incident response team (IRT) or emergency response team (ERT) is a group of people who prepare for and respond to any emergency incident, such as a natural disaster. This is a statutory requirement as per the national guidelines of the IRS.

c) The Orange Book contains specific directions to evacuate people in landslide susceptible areas to safer ground or relief camps depending on the threshold of rainfall warning (Orange or Red Alerts) issued by the India Meteorological Department. Orange Book has directed all Local Governments to prepare details of vulnerable areas and vulnerable groups such as:

- Persons residing in purampokku land
- Persons residing in colonies and along the banks of rivers and canals
- Persons residing adjacent to fields/paddy fields
- Persons residing on hill slopes and isolated locations
- Persons residing in houses were affected by the previous disaster
- Persons residing in purampokku land with houses that have been thoroughly dilapidated or unfit for habitation
- Families residing in vulnerable sites affected by debris flow/landslides/floods in 2018, 2019 or 2021 and those identified as living in vulnerable sites by the Geological Survey of India, State Disaster Management Authority and District Disaster Management Authority.
- People living in plantation labour sheds.

d) It was directed to the DDMAs that the above listed persons should be prioritised during evacuation during extreme rainfall warnings of orange and red levels.

e) Kerala is the only state in the country to entirely notify itself as a Civil Defence State. There are 10,000 Civil Defence Volunteers trained and deployed alongside Fire & Rescue Services for immediate response to any unforeseen events.

f) The State has 4500 Aapda Mitra volunteers.

28. KSDMA is futuristically collaborating with the Geological Survey of India (GSI) to develop an operational landslide early warning system as a pilot, for which the State has signed an MoU with GSI. The project is ongoing in Wayanad district.

29. Amrita Deemed University runs an experimental landslide early warning system at Munnar, Idukki district.

30. A new project is in the final stage of funding from the Kerala Development and Innovation Council to IIT Roorkee with the collaboration of KSDMA for Kanichar Panchayat in the Kannur district.

31. One of the crucial triggers of landslides in Kerala is rainfall. Therefore, establishing automatic rain gauges and weather stations is essential for developing an appropriate landslide early warning system. Based on the recommendation of KSDMA and the specific persuasion of the Government of Kerala, the India Meteorological Department decided to deploy 100 automated weather stations (AWS) in Kerala. KSDMA provided free land of 10 x 12-meter dimension at

100 sites as early as 2020. IMD currently has about 100 operational AWS. KSDMA has also collaborated with world-renowned private weather agencies to obtain weather data.

32. KSDMA funded INR 4 lakhs to DDMA Wayanad for conducting the landslide susceptibility assessment of Ambalavayal and Krishnagiri Villages of Wayanad under the State Disaster Mitigation Fund vide Proceedings No. DM/2356/2018/KSDMA dated 28.11.2018.

33. The State Disaster Management Authority also fund various mitigation measures to prevent landslide hazards. Under the State Disaster Mitigation Fund (SDMF), the Government based on the recommendation of the State Disaster Management Authority has decided to provide funds of INR 1.7 crores to Malappuram district for constructing a retaining wall at Padinhattumuri Desham, Koottilangadi Village, Perinthalmanna Taluk vide GO (Rt) No. 494/2024/DMD dated 21.7.2024. This will directly benefit at least 15 families.

34. In line with the 'living labs approach' of KSDMA, the Authority developed a detailed proposal for handholding Kanichar Grama Panchayat of Kannur district which experienced several landslides in 2022 by creating a Resilience Centre for increasing the climate change and disaster resilience of the Panchayat vide GO (Rt) No. 493/2024/DMD dated 21-7-2024. SDMF also funds this.

35. In 2013, KSDMA conducted a detailed investigation of the landslide that was triggered in Puthussery area inside the forest in Palakkad district, the report of which may be found here (https://shorturl.at/Ybevz). This landslide being unique as it triggered deep inside a forest land provided a significant scientific understanding of the natural landslide triggering processes.

36. Based on various field investigations the professionals of KSDMA published detailed peer reviewed scientific papers in international research journals to validate the findings; such the body of science has also benefited from the experience of KSDMA. The papers were :

- Redefining landslide susceptibility under extreme rainfall events using deep learning. 2024. Geomorphology 448 (9).
- Enhancing the Accuracy of the REPTree by Integrating the Hybrid Ensemble Meta-Classifiers for Modelling the Landslide Susceptibility of Idukki District, South-western India. 2022, Journal of the Indian Society of Remote Sensing 50 (13).
- A framework employing the AHP and FR methods to assess the landslide susceptibility of the Western Ghats region in Kollam district. 2022. Safety in Extreme Environments 4 (171–191).
- Landslide Susceptibility Zonation of Idukki District Using GIS in the Aftermath of 2018 Kerala Floods and Landslides - Comparison of AHP and Frequency Ratio Methods. 2021. Journal of Geovisualization and Spatial Analysis 5 (2).
- Determining the Suitability of Two Different Statistical Techniques in Shallow Landslide (Debris Flow) Initiation Susceptibility Assessment in the Western Ghats. 2014. Environmental Research, Engineering and Management, 70 (4).
- Shallow landslide initiation susceptibility mapping by GIS-based weights-of-evidence analysis of multi-class spatial data-sets: a case study from the natural sloping terrain of Western Ghats, India. 2013. Georisk: Assessment and Management of Risk for Engineered Systems and Geohazards, 8(1).

1.5. 2024 Monsoon Preparedness of Kerala

The southwest monsoon seasonal (June to September, 2024) rainfall was forecasted as to be most likely above normal over South Peninsular India, >106% of LPA (Long Range Forecast Outlook for the 2024 South West Monsoon Season Rainfall, India Meteorological Department, 27-5-2024).

The preparedness of the State to face various disasters that are probable during the monsoon season was as follows:

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 was chaired by the Chief Secretary and Additional Chief Secretary of the Local Self Government Department.

3. 27-05-2024: The 1st long range forecast (LRF) by the India Meteorological Department (IMD). Monsoon seasonal rainfall will be 106% of the Long Period Average (LPA) with a model error of ± 5%.

4. 25-05-2024: Dam Rule Curve Compliance Monitoring Committee chaired by the Principal Secretary, Disaster Management.

5. 30-05-2024: Based on the LRF, the 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. 11-06-2024 to 14-6-2024: Incident Response Team Training for officers of all districts.

7. 12-06-2024: Vide Govt. Ltr. No. DMA1/98/2024-DMD dated 12-6-2024 requested nine teams of NDRF to be pre-positioned in the State, including at Wayanad. The teams were pre-positioned.

8. 26-06-2024: The Minister for Revenue held a review meeting with district collectors to assess the districts' readiness.

9. 27-06-2024: The State Executive Committee met on 27-6-2024 and approved the Orange Book for the year 2024 and recommended the approval of the State Disaster Management Authority chaired by the Chief Minister. The Orange Book was published vide GO (Rt) No. 577/2024/DMD dated 05-08-2024 (http://surl.li/bjgxbt).

10. 01-07-2024: Principal Secretary, Disaster Management & State Relief Commissioner took a review meeting with district collectors to assess districts' readiness.

11. 03-07-2024: The Chief Minister reviewed the status of debris removal from rivers and streams in the State.

12. 04-07-2024: The Minister for General Education reviewed the readiness of the schools to face the monsoon. The General Education Department issued school safety circular considering the monsoon.

13. 05-07-2024: The Chief Minister reviewed readiness at the district level and that of the armed forces. In the meeting, changes brought about to the Orange Book for 2024 were 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 the process flow for requisitioning various services of armed forces from State EOC was reaffirmed and included in the Orange Book so that the turnaround time of the HADR support would be shorter. This readiness of the State in liaison with the armed forces and NDRF ensured a speedy response in Wayanad on 30-07-2024.

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. When the season ended, the official records showed that Kerala received 13% less rainfall than the long period average seasonal rainfall [***Figure 1-3***].

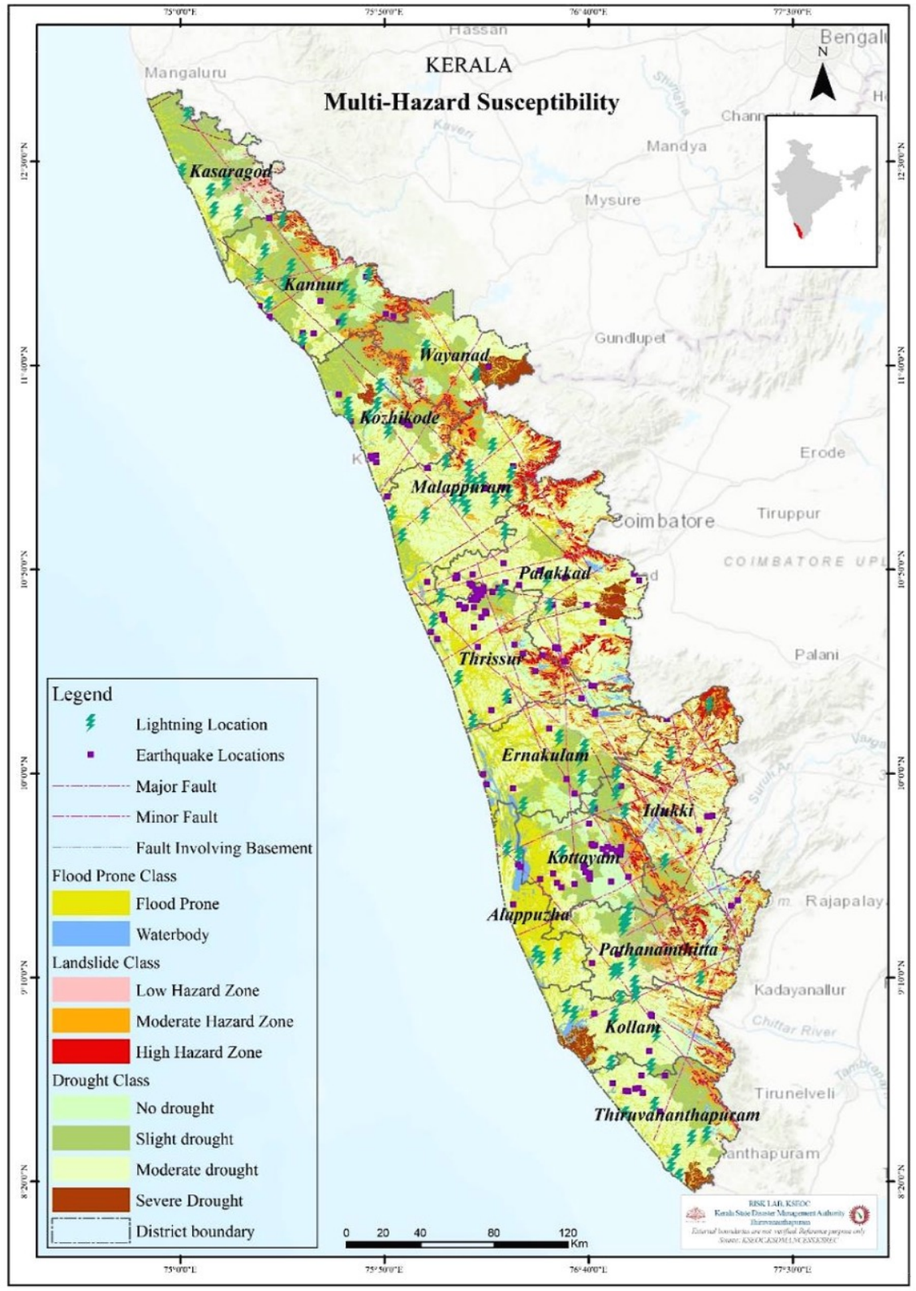


Figure 1-1: *Multi-Hazard Susceptibility of Kerala*

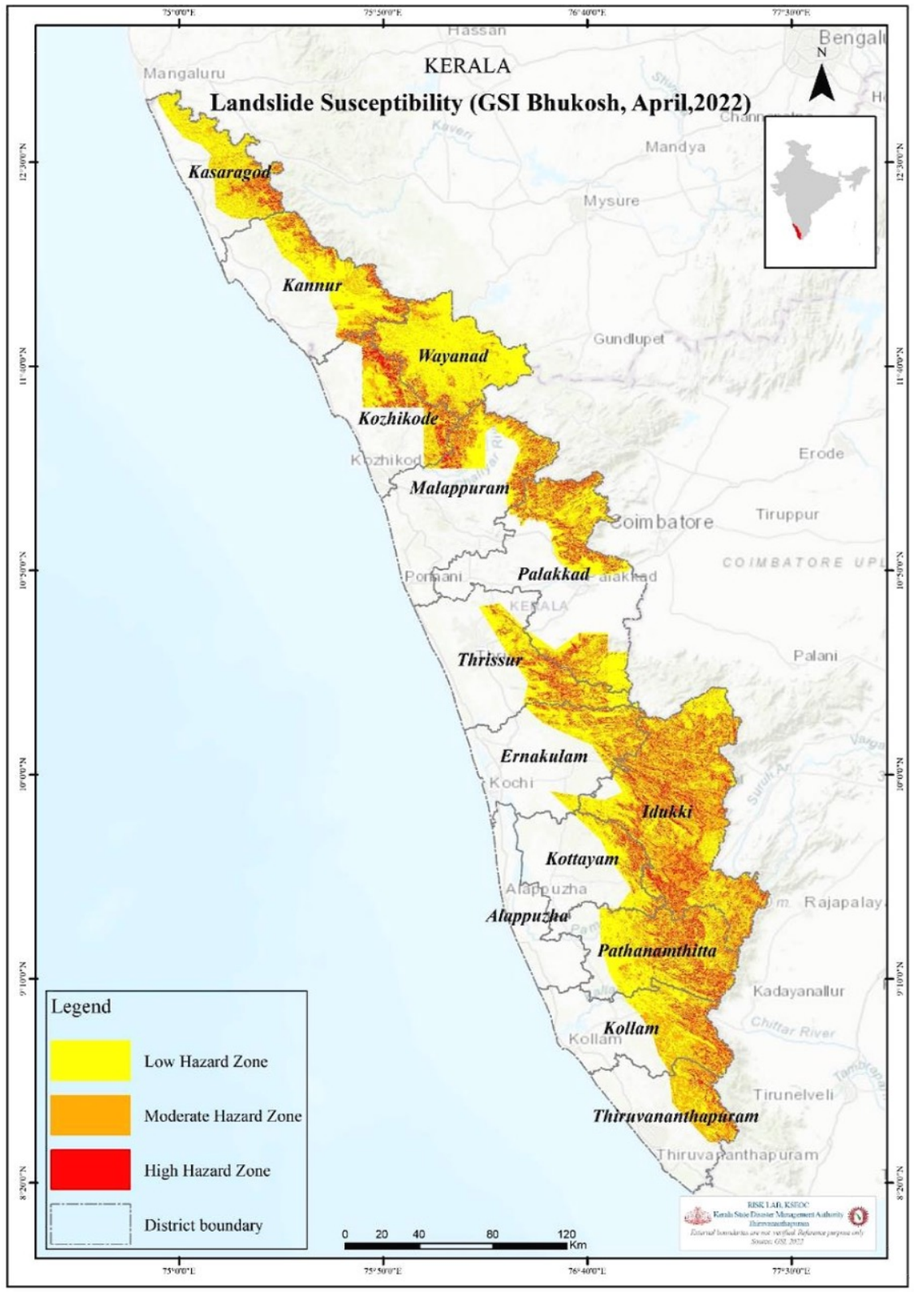


Figure 1-2: *Landslide Susceptibility of Kerala*

भारत सरकार
भारत मौसम विज्ञान विभाग
(पृथ्वी विज्ञान मंत्रालय)
मौसम केन्द्र
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GOVERNMENT OF INDIA
INDIA METEOROLOGICAL DEPARTMENT
(Ministry of Earth Sciences)
METEOROLOGICAL CENTRE
VikasBhavan P.O
Thiruvananthapuram - 695033

SW MONSOON RAINFALL 2024

01 June 2024 to 30 September 2024

SUB DIVISION /DISTRICTS	Actual Rainfall (mm)	Normal Rainfall (mm)	Percentage Departure (%)	
KERALA	1748.1	2018.6	-13	NORMAL
LAKSHADWEEP	1304.2	1026.6	27	EXCESS
ALAPPUZHA	1296.1	1643	-21	DEFICIENT
KANNUR	3023.6	2623	15	NORMAL
ERNAKULAM	1547.1	2116.9	-27	DEFICIENT
IDUKKI	1721.1	2574.3	-33	DEFICIENT
KASARAGODE	2603.3	2846.2	-9	NORMAL
KOLLAM	1065	1257.6	-15	NORMAL
KOTTAYAM	1796.3	1905.3	-6	NORMAL
KOZHIKODE	2309.7	2561.6	-10	NORMAL
MALAPPURAM	1754.7	1956.5	-10	NORMAL
PALAKKAD	1505.9	1556.1	-3	NORMAL
PATHANAMTHITTA	1330.5	1572.7	-15	NORMAL
THIRUVANANTHAPURAM	866.3	844.6	3	NORMAL
THRISSUR	1871.3	2132.1	-12	NORMAL
WAYANAD	1713.3	2464.7	-30	DEFICIENT
MAHE	2755.4	2385.3	16	NORMAL

Percentage departure from normal value

Large Excess : +60% and above **Excess: +20% to +59%** **Normal : +19% to -19%**
Deficient : -20% to -59% **Large Deficient: -60% to -99%** **No rain :-100 %**

Figure 1-3: *South West Monsoon Rainfall 2024 (IMD)*

Table 1-3: Hazard profile of Wayanad district

Sl. No.	Classification	Types of Disaster
1	Naturally Triggered/ Weather Related	Flood
		Thunder and lightning
		Drought
2	Geological	Earthquakes
		Landslides
3	Biological	Epidemics
		Cattle epidemics
		Food poisoning
		Pest attack
4	Anthropogenic/Technologically triggered	Fireworks accidents
		Road accidents
		Human triggered forest fire
		Short circuit and related fire
		Building collapse
		Tourism related drowning
		Hooch accident

[Source: District Disaster Management Plan, Wayanad 2015]

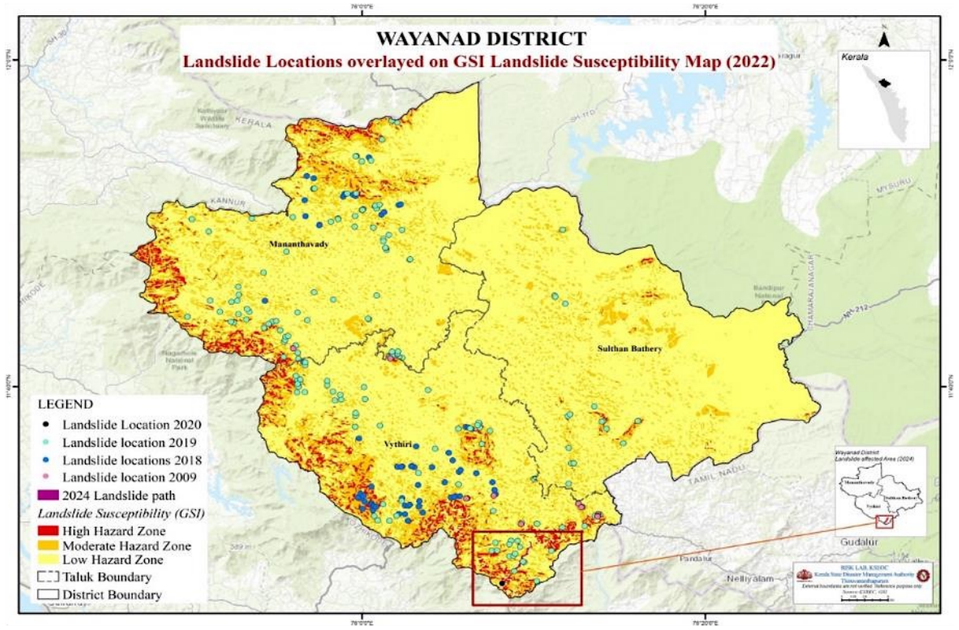
1.6. Disaster profile of Wayanad

Wayanad district, located at the southern extremity of the Deccan Plateau and within the Western Ghats, is susceptible to a range of natural hazards. Classified under Zone III, the district is categorized as a Moderate Risk Damage Zone for earthquakes. The plateau-like ridges of the Western Ghats characterize the region's topography. Landslides have plagued Wayanad district on numerous occasions in the past. The hazard profile of the district is given in [***Table 1-3***]. A detailed description of the disaster profile of Wayanad district can be seen in the district's disaster management plan (https://tinyurl.com/WayanadDMPlan).

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 – Kalpetta 50, Sulthan Bathery 20, Mananthavady 40)	110
3	Aapda Mitra Volunteers (attached to Fire and Rescue Services Stations – Kalpetta 70, Sulthan Bathery 89, Mananthavady 41)	200
4	National Disaster Response Force (pre-positioned at Meenangadi town of Wayanad in June 2024)	30

Table 1-4: Disaster response forces present in Wayanad in 2024

Figure 1-4: Landslide Susceptibility of Wayanad



1.7. 2024 Monsoon preparedness of Wayanad

Wayanad district started its preparedness for monsoon season in May. The district has various response forces available as given in [Table 1-4].

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 morning by 10.00 A.M. The data is collected through a Mobile App.
- Disaster Resource Management.
- DM Clubs for Students – the Schools of Wayanad have DM clubs which the District Panchayat funds.
- Trainings for Resilient Constructors.

The DDMA started its preparedness early in the month of May 2024 to face the monsoon. The activities are mentioned below [***Table 1-5***]:

1.8. Landslide Susceptibility of Wayanad

The Geological Survey of India has identified the Wayanad-Kozhikode border as one of the most landslide-susceptible regions in the state [***Figure 1-4***].

Notable landslides include the Mundakkai debris flow in 1984 (claimed 14 lives), the Kappikkalam Urulpottal (debris flow) near Padinjarethara in 1992 (claimed 11 lives), the catastrophic Valamthode landslide in 2007 (claimed four lives) and the Puthumala landslide in 2019 (claimed 17 lives). These events resulted in significant loss of life and property.

In addition to these notable landslides, Wayanad has experienced numerous other landslides of similar nature and varying magnitude in the past. One such landslide occurred on the Ambalavayal-Kumbaleri road, near Arattupara and Phantom Rock. [***Figure 1-4***] highlights regions with high, moderate, and low landslide risk. Notably, the western and southern portions of the district

Sl. No.	Date	Time	Event	Decisions
1	09.05.2024	11.00 A.M	Offline-Meeting Drought & Monsoon Preparedness	All nodal departments attended the meeting.
2	26.06.2024	05.00-06.00 A.M	Monsoon emergency meeting of nodal officers regarding Heavy Rainfall Warnings	Entire Tourist Destination - including Public& Private. Earth Cutting and Quarrying have been banned
3	28.06.2024	11.00 A.M-12.30 P.M	Monsoon emergency review meeting regarding Heavy Rain-fall Warnings	Review Meeting with all nodal Departments regarding the Monsoon Preparedness
4	16.07.2024	11.30 A.M-12.30 P.M	Monsoon preparedness meeting	Earth Cutting and Quarrying have been banned. Trekking at 900 Kandi & Edakkal Caves has been stopped until further orders
5	17.07.2024	04.30 P.M-5.30 P.M	Monsoon emergency meeting with Tahsildars, Geology, Soil, PRD, KSEB, JD-LSGD, DAM Authorities	Vulnerable people should be moved to camps
6	19.07.2024	12.00-1.00 P.M	Charge Minister review meeting	Review Meeting with all nodal Departments regarding the Monsoon Preparedness
7	21.07.2024	10.30-11.30 A.M	Emergency meeting: Tahsil-dars, Geology Soil, PRD, KSEB, JD-LSGD, DMO	Review
8	21.07.024	05.30-06.30 P.M	Emergency meeting-Tahsil-dars, Geology, Soil, PRD, KSEB, JD-LSGD, DMO	Review
9	22.07.2024	10.45-11.45 A.M	Emergency meeting: regarding the rise in water level of Banasura Dam-Tahsildars, Geology, Soil, PRD, KSEB, JD-LSGD, DAM Authorities	Review
10	29.07.2024	12.00 P.M	District Planning Committee	Review

Table 1-5: *2024 Monsoon Preparedness of Wayanad*

are classified as high-hazard zones.

Wayanad has experienced several catastrophic landslides, including those at Mangalassery Mala and Thavinjal in 2018, Panjarakolli, Kurchyarmala, Valad, Mattilayam, Kappikkalam, and Kunnathidavaka, also in 2018, Chembra in 2018 and 2019, Puthumala in 2019, and Mundakkai in 2020. [***Figure 1-1***] also shows the locations of these landslides overlaid on the landslide susceptibility map. These overlays provide valuable insights into landslide risks in the region, highlighting areas prone to such events.

The district has a standard operating procedure [***Table 1-6***] and a pre and post landslide antici-

Criteria: 1. When IMD issues a hefty rainfall warning 2. When two days of cumulative rainfall exceeds 8 cm in a rain station, a landslide warning is issued to the respective district	
Landslide Alert	• Be prepared – Actions to be taken and sustained till the warning time limit expires/ until 2 days cumulative rainfall is below 8 cm
	• SEOC - Telephonically verify the warning from INCOIS
	• SEOC & DEOC - Emergency time functions activated
	• State-District - Taluk Control Rooms of Revenue & Police with 24-hour functioning
	• SDRF & Coastal Police-deployed to the coastline
	• Army, Navy, Air Force & other Central Forces in the state- on high alert and standby
	• BSNL & Police-deploy emergency communication systems
	• Hospitals and PHCs in the district function at full strength 24hrs
	• Tahsildar - Take control of the identified relief shelters, and quarry blasting will be banned until 24 hrs. of rain free situation arises in the quarry locality based on the evaluation by the village officers
	• Local Self Governments: Alert public living close to small rivulets and in hilly segments with greater than 20-degree slope
[Source: District DM Plan Wayanad 2015]	

Table 1-6: *Standard Operating Procedure for Landslide Preparedness in the District*

Table 1-7: *Framework for anticipated needs during pre and post landslide scenario*

Anticipated Needs for Pre-Landslide		Anticipated Needs for Post -Landslide	
Structural	**Non – Structural**	**Rescue**	**Relief**
Improving surface and subsurface drainage	Identify the landslide prone areas in the district and have close monitoring during the monsoon season	JCB, Crane	Food
Constructing piles & Retaining wall	Monitoring & updating landslide related parameters	Ambulance	Shelter
Preserving vegetation	Public awareness campaigns	Rescue equipments	Financial aid
Rockfall protection	Update resource inventory	Human resources	Cooked food
Boulder – gathering trenches at the foot of the hillside	Collect details of earthmovers, cutters, JCB's and other related machineries in the district	Mobile clinics	Safe drinking water
Lowering the slope	Storage of medicine	Life saving equipments	Electricity
Disseminating landslide hazard mapping information to stakeholders at selected locations demonstrates mitigation actions using local resources/cost effective measures.		Medicines/Vaccination	

pated needs framework [***Table 1-7***] to react to landslide events.

1.9. Disaster Risk Reduction Measures of Meppadi Grama Panchayat

Meppadi Grama Panchayat is in Vythiri Taluk of Wayanad district [***Figure 1-5***]. Covering an area of 125.94 km² and with a population of 37,785, the Panchayat has a population density of 300/km².

The local self-governments of Wayanad district have disaster management plans prepared based on a consultative process supported by the Kerala Institute of Local Administration and Kerala State Disaster Management Authority.

The Meppadi Grama Panchayat, affected by the landslide, also meticulously prepared a Disaster Management Plan (http://surl.li/vvfypv). 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 preparing annual plans. Section 7.2 of this guideline allows local self-governments to create projects to implement priority projects identified in the disaster management plans utilizing the annual development funds available with the Local Self Governments. The landslide impacted locations are identified as susceptible sites in the Meppadi Grama Panchayat disaster management plan.

Capacity Building of School Children

The schools of Wayanad have functional School Disaster Management Clubs (SDMC) nurtured by the District Disaster Management Authority, funded by the State Disaster Management Authority and District Panchayat. This initiative establishes a disaster preparedness and response framework within educational institutions.

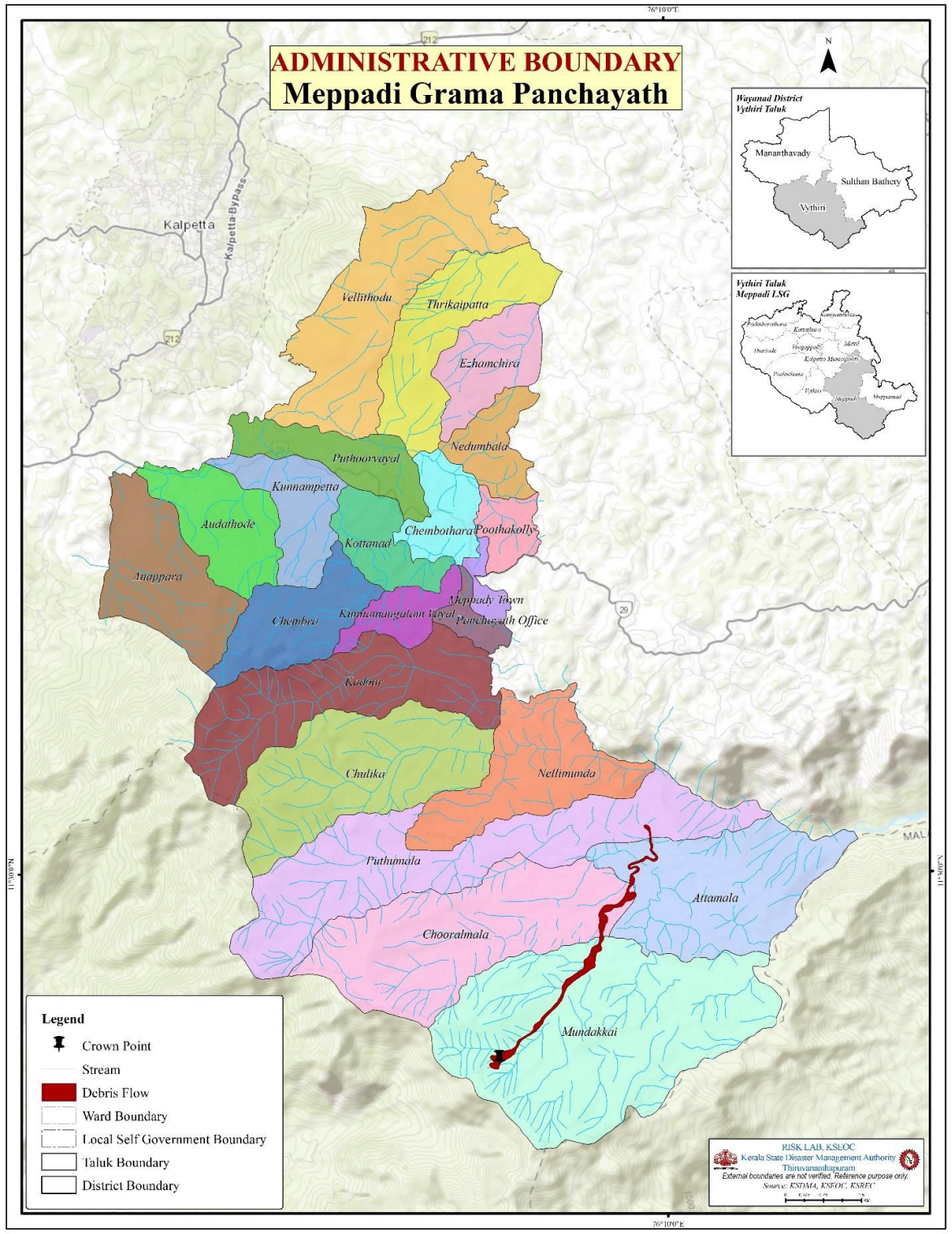


Figure 1-5: *Administrative Boundary of Meppadi Grama Panchayat overlaid with the landslide footprint*

Training sessions have been conducted for students who are members of the SDMC, equipping them with the skills necessary to handle any adverse situations effectively. During the program, participants are briefed on the following and attend mock drills:

- An overview of disasters, their types, and effects.
- Roles and responsibilities of the National Disaster Response Force (NDRF).
- Safety protocols include the Drop, Cover, and Hold technique before, during, and after an earthquake.
- Direct and indirect rescue methods during floods, Creation of improvised floating devices.
- Construction of improvised stretchers.
- Techniques for controlling bleeding and managing head injuries.
- Procedures for dealing with extruded eyes and impaled objects.
- Stabilization methods for shoulder dislocations
- Cardiopulmonary resuscitation (CPR) and foreign body airway obstruction (FBAO) for adults and infants.
- Lifting and carrying techniques (two, three, and four-hand methods).
- Introduction to basic rope knots.
- Briefings on weather-related applications such as the Mausam, Damini, Sagar Vani, and Bhookamp apps.

As part of the SDMC initiative, the schools in Meppadi Grama Panchayat conducted mock drills and awareness workshops in collaboration with NDRF in the last 9 months before the landslide [***Table 1-8***]. Glimpses of the awareness and mock drill can be seen in ***Figure 1-6***.

Sl. No.	Date	School
1	05.08.2023	GHSS Meppadi
2	17.08.203	Mount Tabour
3	20.09.2023	GHS Thrikkaipetta
4	26.10.2023	GHS Rippon
5	26.06.2024	GVHSS Vellar-mala

Table 1-8: *Mock drills and awareness classes held in the schools of Meppadi Grama Panchayat in the last 9 months before the landslide*



Figure 1-6: *Glimpses of mock drills and awareness workshops in schools of Meppadi*

Figure 1-7: *Glimpses of training programmes for Aapda Mitra and Civil Defence*



Civil Defence and Aapda Mitra of Meppadi

There are four Civil Defence volunteers and ten Aapda Mitra volunteers in Meppadi. Their names are given in ***Table 1-9***.

These volunteers are trained with a syllabus of a 15-day training program, which includes three levels of training: local level (at respective Fire & Rescue Stations), district level, and state level. The days of the training program are given in ***Table 1-10***. The topics on which training is carried out include First Aid, Flood Rescue Training, Fire Fighting, Search and Rescue, Public Health Care and Camp Management [***Figure 1-7***].

Tribal community inclusive Disaster Risk Reduction of Meppadi

Wayanad district has pioneered the empowerment of the tribal community in disaster risk reduction. As part of this, the district has prepared Tribal Hamlet-based Disaster Management Plans and has conducted focused training for the youth from these hamlets (https://sdma.kerala.gov.in/tribal-colony-dm-plans/). The tribal hamlets of Meppadi also have a disaster management plan (http://surl.li/trzutc.) Training programs conducted for the youth of the tribal hamlets of Meppadi are given in ***Table 1-11***.

1.10. Preparedness of Meppadi Grama Panchayat from 29.07.2024

An evacuation drive was initiated at 05. 00 A.M. on July 29, following a minor landslide earlier that morning, with the District Panchayat President, co-chair of the district disaster management authority, Aapda Mitra Volunteers (the official disaster management volunteers trained by Disaster Management Authorities), Police, Revenue officials and Local Government aiding in the evacuation and alerting residents living in Punchirimattam, Mundakkai and Chooralmala



Figure 1-8: *Glimpses of training programmes as part of tribal community inclusive Disaster Risk Reduction*

Table 1-9: Civil Defence and Aapda Mitra Volunteers of Meppadi

Sl. No.	Name	Volunteer Force
1	Mr Muhammed Usa-math	Aapda Mitra
2	Mr Prabhakaran V	Aapda Mitra
3	Ms. Faseela P. P	Aapda Mitra
4	Mr Riyas P	Aapda Mitra
5	Mr Shahirali P	Aapda Mitra
6	Mr Unaf Y	Aapda Mitra
7	Mr Arunraj T. R	Aapda Mitra
8	Mr Sinsil T	Aapda Mitra
9	Ms. Alakananda V	Aapda Mitra
10	Ms. Sneha T. P	Aapda Mitra
11	Mr Abdul Majeed	Aapda Mitra
12	Mr Damodharan K	Civil Defence
13	Mr Mujeeb K	Civil Defence
14	Ms. Vijayakumari N. S	Civil Defence

Sl. No.	Date	Level of training
1	26.12.2019 to 31.12.2019	Station Level
2	11.10.2020 to 16.10.2020	District level
3	01.02.2021 to 03.02.2021	State Level
4	06.11.2023 to 11.11.2023	State Level
5	13.11.2023 to 11.11.2023	District level
6	11.12.2023 to 13.12.2023	State Level

Table 1-10: Days of Civil Defence and Aapda Mitra Volunteers Training

settlements mainly along the river banks, and restricting tourist access to Chooralmala area, which is evident from various news reports and statements of local community members in Malayalam, the regional vernacular (Mathrubhumi News 29.07.2024: https://youtube.com/shorts/EodVVAtijHg; Mathrubhumi News 29.07.2024: https://youtu.be/BzWDpUQENts; Manorama News 29.07.2024: https://youtu.be/a9hBEc833ww). The team evacuated 15 individuals from Punchirimattam noticing a small landslide and alerted 50 individuals, some of whom left Mundakkai and Punchirimattam to relatives' houses. The camp was also started in GVHSS Vellarmala. The District Panchayat President also alerted the Local Self Governments in the District Planning Committee meeting on 29.07.2024 at noon. Many individuals, noticing the rainfall and the presence of officials intuitively moved to safer areas. The anticipatory actions and the local intuitions of locals saved many precious lives.

1.11. Official Forecasts

According to the 5-day rain forecast IMD issued on July 27, 2024, a yellow alert was issued for Wayanad district. The warning remained the same as the forecast for July 28, and only a yellow alert was issued for Wayanad district on July 29 and 30. According to the forecast issued on July 29 afternoon, Orange Alert was announced for Wayanad district only on the 29th of July. This forecast of Orange Alert implies that rainfall between 115 and 204 mm can be expected in 24 hours. The alert for 30, July 2024

Sl. No.	Date	Type of Training	Location of training	No. of participants
1	22.02.2021	Capacity building for tribal youth of Idinjakolly, Govindanpara, Vellakettu, and Vengachoolla	GHS Thrikaipetta	83
2	10.12.2021	Basic survival skills, CPR & Fire and Safety techniques	Vengachoola	87
3	20.12.2021	Draft template discussion on tribal hamlet DM plans with Tribal Development Officers, Tribal Extension Officers, Community Social Workers, and Tribal Promoters	Round conference hall	50
4	21.12.2021 - 23.12.2021	Taluk level finalization of tribal hamlet DM plans with Tribal Development Officers, Police Department Officers, Revenue Officials, Health Officials, LSGD Officials, Rural Specialists, Fire & Rescue Officers, Community Social Workers, Tribal Promoters, NGOs, and MSW students	Various taluk offices	150
5	16.01.2023	Hands-on training on CPR for tribal youth of Idinjakolly, Govindanpara, Vellakettu, and Vengachoolla	Fire Station, Kalpetta	42 (24 men and 18 women)
6	19.01.2023	Advanced swimming rescue training for tribal youth of Idinjakolly, Govindanpara, Vellakettu, and Vengachoolla	Swimming pool, Kalpetta	42 (24 men and 18 women)

Table 1 - 11: Tribal community inclusive disaster risk reduction programme - trainings

for Wayanad district was 'Yellow' [***Figure 1 - 9***].

As Orange Alert was issued on 29.07.2024, appropriate steps were taken as per the Standard Operating Procedure to inform vulnerable populations through various media and preparedness was reviewed as part of the District Planning Committee held on 29.07.2024 [***Table 1-5***]. Considering the possibility of landslides, landslide alerts were issued by the State and Wayanad District Emergency Operations Centre and appropriate anticipatory evacuation was carried out by Revenue and Local Self Governments in various panchayats. It is pertinent to reiterate that evacuation drives started in various Grama Panchayats of Wayanad on 29.07.2024 even before IMD issued the orange alert. Alerts and warnings were heeded by many families, resulting in the saving of lives.

No operational landslide early warning system except an experimental system of the Geological Survey of India (GSI) was available for the area. The system implemented by GSI uses a regional rainfall threshold-based approach for issuing experimental forecasts which is in a testing stage and is not operationally used. The forecast from the experimental system heavily depends on rainfall forecasts. On 29.07.2024, 02.00 P.M., the experimental system forecasted a 'green' alert for Vythiri Taluk in which Meppadi Grama Panchayat falls for 29.07.2024 and 30.07.2024 [***Figure 1-10***].

1.12. Meppadi Landslide of 30-7-2024

On July 30, 2024, at approximately 01:15 A.M., a major landslide occurred in the arcuate-shaped micro-watershed of Punchirimattam Hill along Punnapuzha River which is a tributary of Chaliyar river [***Figure 1-11***]. The landslide originated in a densely forested topographic hollow of a first-order stream and flowed through Punnapuzha stream and coalesced with Padavetti Puzha, joining the Chaliyar river further downstream.

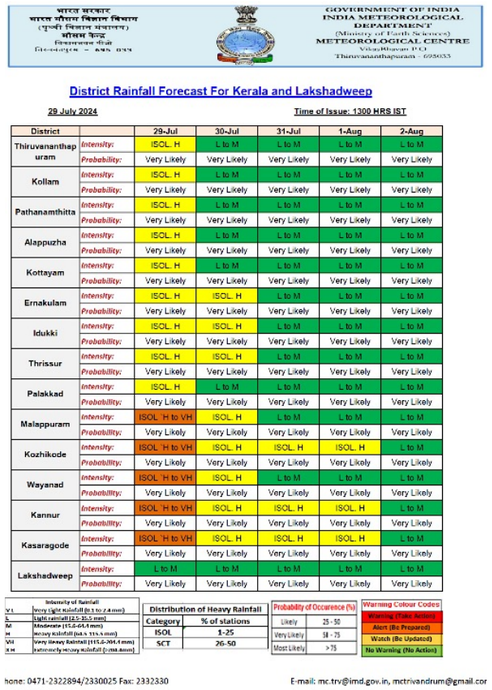
The nearest official rainfall recording station is at Kalladi (5 kms to the north of the crown of the landslide; owned by the Irrigation Design & Research Board, Department of Water Resources, Government of Kerala) where the rainfall recorded on 29.07.2024 was 200.2 mm and 30.07.2024 was 372.6 mm.

The rainfall recorded at Kalladi was twice the average rainfall of the district on 30.07.2024 [***Figure 1 -12***]. The salient features of the landslide are captured in ***Table 1-12.***

After analysing climate models with high resolution to capture precipitation over the relatively small study region, Zachariah et al., 2024 concludes that 'overall, the available climate models indicate a 10% increase in one-day rainfall intensity. Under a future warming scenario where the global temperature is 2°C higher than pre-industrial levels, climate models predict even heavier 1-day rainfall events, with a further expected increase of about 4% in rainfall intensity.'

Underlying complex geology, with sheared rocks and structural discontinuities, contributes mainly to the causes of failure, which are exacerbated by excessive rainfall. Water infiltration through three joint sets in the gneissic complex led to severe weathering and erosion, with soil thickness exceeding 30 meters, increased thereby increasing susceptibility to such an event. Simulations show that the debris flows initiated around 00:30 hrs, peaked at approximately 03:30 hrs on July 30, 2024, and reached a maximum velocity of 28.24 m/s. The volume of the eroded materials from the event was estimated as 5.17×106 – 5.72×106 m3, ranking it as one of India's most enormous debris flows [***Figure 1-16***].

Field assessments indicate that the landslide and the entrapped wooden logs and boulders resulted in three landslide dams that collapsed rapidly. The debris flows runup height in the transitional (deposition dominant) zone (up to 32 m) was enhanced by multiple damming effects and entrainment and topographic attributes such as cascades and river sinuosity, causing extensive infrastructure damage [***Figure 1-18***]. Field observations and aerial imagery support the fact that the landslide was not of anthropogenic origin (Yunus et al., 2024).



भारत सरकार
भारत मौसम विज्ञान विभाग
(पृथ्वी विज्ञान मंत्रालय)
मौसम केन्द्र
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GOVERNMENT OF INDIA
INDIA METEOROLOGICAL DEPARTMENT
(Ministry of Earth Sciences)
METEOROLOGICAL CENTRE
Vikas Bhavan P.O
Thiruvananthapuram - 695033

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:
VL: Very Light rainfall (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)
EH: Extremely Heavy rainfall (≥204.4mm)

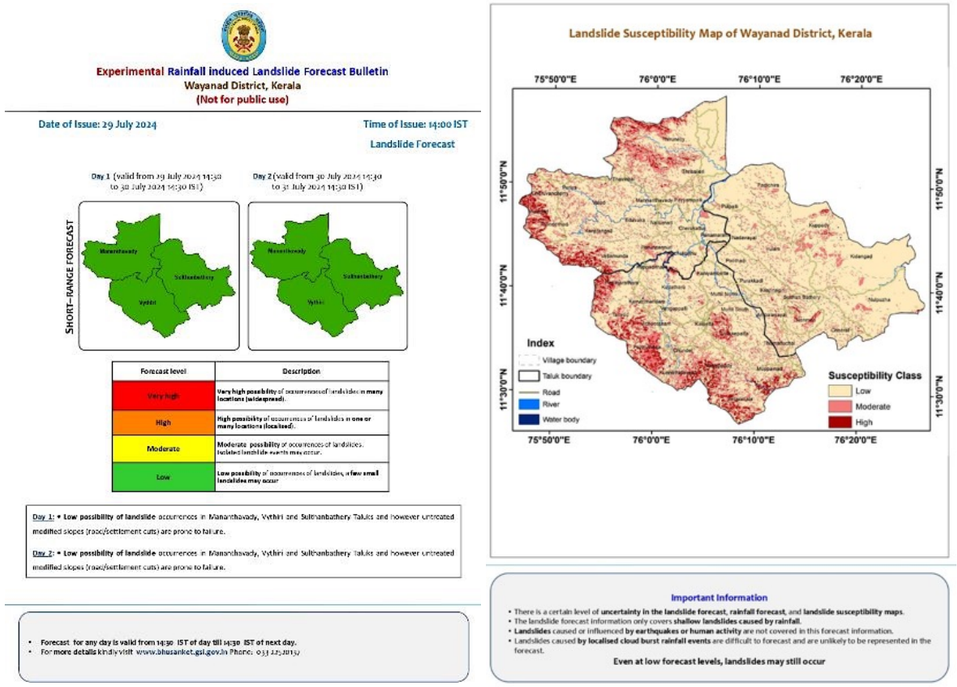
Distribution of Heavy Rainfall	
Category	% of stations
ISOL	1-25
SCT	26-50

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

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

hone: 0471-2322894/2330025 Fax: 2332330 E-mail: mc.trv@imd.gov.in, mctrivandrum@gmail.cor

Figure 1-9 (left):
District wise rainfall forecast for Kerala issued by IMD on 29-7-2024, 01:00 P.M



Experimental Rainfall induced Landslide Forecast Bulletin
Wayanad District, Kerala
(Not for public use)

Date of Issue: 29 July 2024 — Time of Issue: 14:00 IST

Landslide Forecast

Day 1 (valid from 29 July 2024 14:30 to 30 July 2024 14:30 IST)

Day 2 (valid from 30 July 2024 14:30 to 31 July 2024 14:30 IST)

SHORT-RANGE FORECAST

Forecast level	Description
Very High	Very high possibility of occurrences of landslides in many locations (widespread).
High	High possibility of occurrences of landslides in one or many locations (localised).
Moderate	Moderate possibility of occurrences of landslides. Isolated landslide events may occur.
Low	Low possibility of occurrences of landslides, a few small landslides may occur

Day 1: • Low possibility of landslide occurrences in Mananthavady, Vythiri and Sulthanbathery Taluks and however untreated modified slopes (road/settlement cuts) are prone to failure.

Day 2: • Low possibility of landslide occurrences in Mananthavady, Vythiri and Sulthanbathery Taluks and however untreated modified slopes (road/settlement cuts) are prone to failure.

- Forecast for any day is valid from 14:30 IST of day till 14:30 IST of next day.
- For more details kindly visit www.bhuvanket.gsi.gov.in Phone: 033 2231 2013

Landslide Susceptibility Map of Wayanad District, Kerala

75°50'0"E 76°0'0"E 76°10'0"E 76°20'0"E
11°50'0"N 11°40'0"N 11°30'0"N

Index
Village boundary
Taluk boundary
Road
River
Water body

Susceptibility Class
Low
Moderate
High

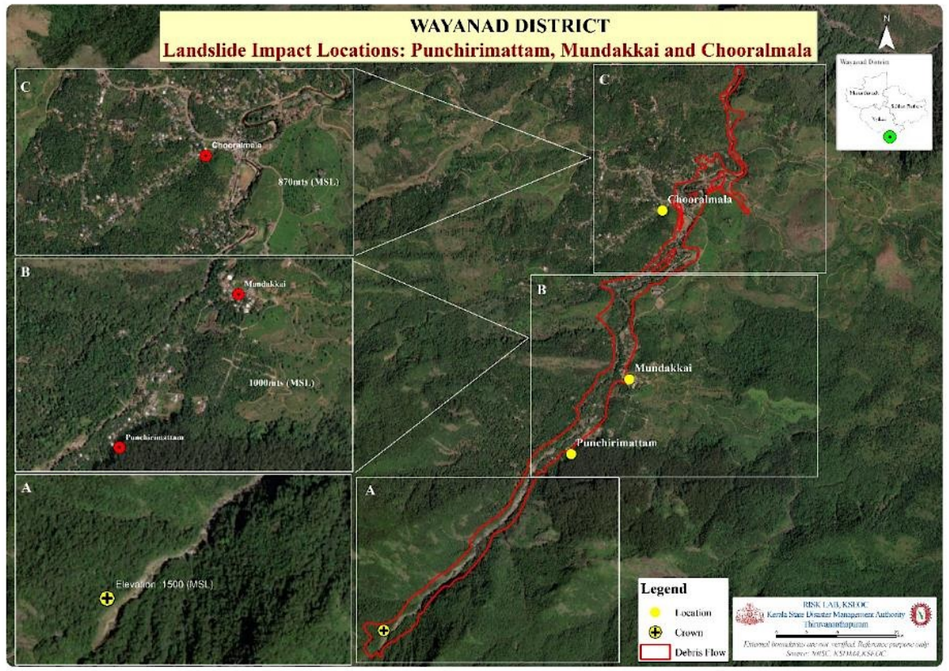
Important Information

- There is a certain level of **uncertainty in the landslide forecast, rainfall forecast,** and **landslide susceptibility maps.**
- The landslide forecast information only covers **shallow landslides caused by rainfall.**
- **Landslides** caused or influenced **by earthquakes or human activity** are not covered in this forecast information.
- Landslides caused **by localised cloud burst rainfall events** are difficult to forecast and are unlikely to be represented in the forecast.

Even at low forecast levels, landslides may still occur

Figure 1-10 (below):
Experimental rainfall induced landslide forecast bulletin of Wayanad issued by GSI on 29.07.2024, 02:00 P.M

Figure 1-11: *Landslide Impact Locations and runout path*



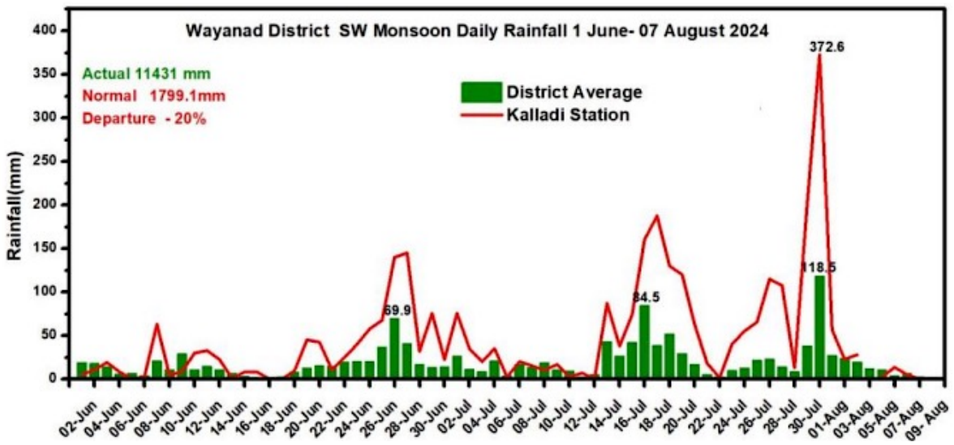


Figure 1-12: *Daily average rainfall of Wayanad District and daily rainfall recorded at Kalladi Rain Gauge from 1st June to 7th August, 2024*

1.13. Impact of the disaster

- **Human Fatalities:**
  251 bodies have been found, and 47 individuals are reported missing. Estimates indicate:

- **Injuries:**
  A total of 378 people were injured, requiring hospitalization for more than one week. 25 individuals have disabilities of more than 60%, and 70 individuals have disabilities ranging from 40% to 60%.

- **Displacement and Livelihood Impact:**
  4102 individuals stayed in relief camps, with 1871 still in camps as of 1st August 2024, and 2231 moved to relatives' houses. About 2010 adults will be unable to return to normal livelihood for the next 90 days.

- **Housing Damage:**
  A total of 1,555 houses were severely damaged or destroyed, 452 were partially damaged, and 35 huts were damaged and 111 farmers lost their cattle sheds.

- **Drinking Water Supply:**
  Drinking water needed to be supplied to affected areas, with ongoing efforts to provide clean water.

- **Agriculture:**
  626 hectares of crops were affected, impacting both small and marginal farmers. This area is known for coffee and cardamom cultivation.

- **Infrastructure Damage:**
  Roads, bridges, drinking water supply schemes, power transformers, poles, and LT lines were all damaged.

- **Debris Clearance:**
  Debris spread over 1 sq. km. needs to be cleared, involving heavy equipment. Draining of flood water from affected settlements is also required.

- **Loss of Life:**
  Unidentified bodies and body parts have been found, necessitating DNA sampling for identification and burial.

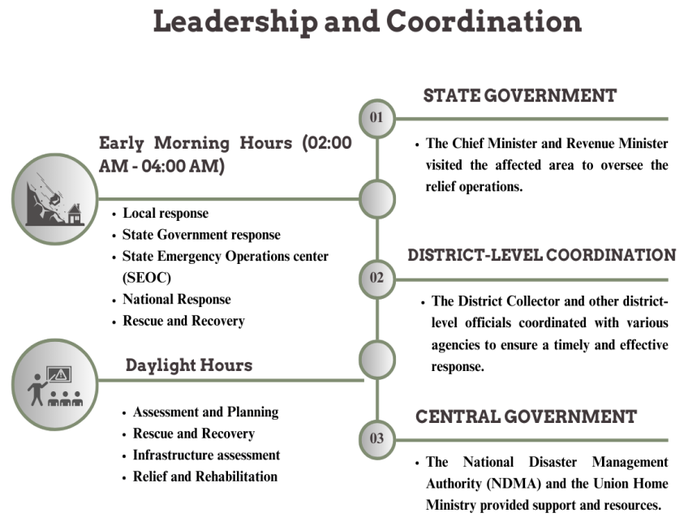
- **Economic Impact on Artisans:**
  Artisans in the impacted area lost equipment and raw materials, affecting their livelihoods.

- **Animal Husbandry:**
  Livestock losses included a total of 226 cows, 165 goats, 1032 poultry (hen) and 26 rabbits were lost, as reported by Animal Husbandry.

Administrative area	Meppadi Grama Panchayat, Vellarimala Revenue Village, Vythiri Taluk [*Figure 1-5*]					
Landslide Crown	Punchirimattam Evergreen Forest					
Type of event	The debris slide transformed into a debris flow that channelled through the Punnapuzha River (a tributary of the Chaliyar River) [*Figure 1-11*]					
Affected area	0.98 km2					
Length of the runout	8 km (from crown to deposition zone) travelled through Punnapuzha					
Affected wards	10, 11, 12					
Affected settlements	Punchirimattam, Mundakkai, Chooralmala and Attamala [*Figure 1-11*]					
Impact on geomorphology	The Punnapuzha river, a tributary of the Chaliyar River, which experienced the landslide and consequent debris flow, widened from approximately 20 to 40 meters to 200 and 300 meters.					
Causative rainfall	At Kalladi Rain Gauge, IDRB, Dept. of Water Resources, Govt. of Kerala [*Figure 1-12*] • 29-7-2024: 200.2 mm • 30-7-2024: 372.6 mm					
Damages	Fatality	251	Missing	47	Families displaced	702
	Cattle	226	Buffalo	12	Goats	165
	Poultry	1032	Hospital	1	Bridges	3
	Schools	2	Health Centre	1	Roads	14.2

Table 1-12: *Salient features of Meppadi Landslide*

1.14. Immediate response



Early Morning Hours (02:00 AM - 04:00 AM)

- On July 30, 2024, early morning, after hearing a suspected landslide sound, an immediate rescue operation and evacuation of people was initiated under the leadership of the locals and trained Aapda Mitra and Civil Defence Volunteers of the Grama Panchayat.
- Between 12.00 A.M and 01.30 A.M government agencies such as police, fire & rescue services, local self-government, and revenue officials reached the disaster affected area. The NDRF team, which was maintained in the district, moved to the site.
- The State Emergency Operations Centre (SEOC) received information about the first landslide at 02.05 A.M via ERSS112. After examining the accuracy of the information, the information was conveyed to the office of the Chief Minister by the SEOC around 02.30 A.M.
- The SEOC also informed the Minister for Revenue and the Secretary of the Disaster Management Department. As the severity was evident, the Government sought help from various central agencies.
- Locals heard a second sound around 02.30 A.M. The third loud sound was heard around 03.30 in the morning.
- The district hazard analyst started at around 03.00 A.M and streamed video from the site to SEOC.
- The rescue workers standing in Chooralmala School Road ran away after hearing this noise at 03.30 A.M and debris gushing towards them.
- When the debris flow subsided and the rescuers returned to School Road, they witnessed catastrophic damage to numerous houses.
- At around 03.49 A.M, top officials of the National Disaster Management Authority and the Union Home Ministry were informed by SEOC, and requests for more rescue forces were made. The National Disaster Response Force, deployed in Wayanad district in advance, started the rescue operation around 04.30 A.M. By 04.55 A.M, the SEOC requested the help of the Army. By 05.49 A.M, the necessary action to deploy the Air Force had been triggered.

Figure 1-13 Planning the rescue and response



Force	Number	Force	Number
Fire & Rescue	360	Civil Defence	200
Aapda Mitra	100	Police	300
NDRF	126	Defence Security Corps	187
Army	582	MEG (ETF)	154
Air Force	2 helicopters and multiple fixed wings	Territorial Army	45
Army Cadaver Dogs	5 dogs	Navy	137
Coast Guard	26	Civil Society Organizations	2000+
TNDRF	21	Zaver & Recco Radars	5 Nos

Table 1-13: *Deployment of response forces in Meppadi Grama Panchayat, Wayanad within 48 hours of Landslide*

Daylight Hours

- By 10.26 A.M, to build Bailey Bridge, by 11.45 A.M Navy's specially trained river crossing teams, and by 12.13 P.M Army's cadaver dogs were requisitioned by SEOC.

- Early in the morning, the Chief Minister and the Minister of Revenue visited the SEOC to assess the situation. The action plan prepared by the SDMA for the rescue operation was reviewed in a meeting with the state senior officials, and necessary instructions were given to the DEOC and various response agencies. Three ministers were immediately sent to the incident site and assigned to camp there to coordinate the rescue operation.

- The Inspector General of Police (North Zone, Kerala) was appointed as the onsite Incident Commander. Thus, within the first 48 hours of the disaster, the State could mobilize maximum resources to respond to the event [***Table 1-13***].

Through this prompt response, 630 individuals found trapped in the landslide debris were moved to hospitals and 1300 individuals trapped in inaccessible areas were moved to safer locations. Fire and Rescue Service built a temporary footbridge. Subsequently, a Bailey Bridge was deployed by the Indian Army which enabled faster access to isolated areas.

Hon'ble Chief Minister held an all-party meeting at Wayanad on 01.08.2024 and visited the site on 02.08.2024. An inter-ministerial central team appointed by the Ministry of Home Affairs visited the site on 08.08.2024. Hon'ble Prime Minister visited the site on 10.08.2024.

Operational Teams[1] and Functions

In the aftermath of the Chooralmala disaster, the district administration implemented a comprehensive and coordinated disaster response plan. The administration aimed to enhance collaboration between government agencies and local communities by appointing departmental nodal officers.

The response plan outlined in Order No: DCWY-D/2864/2024-DM3, dated August 1, 2024, [Refer: Annexure 1 - 1.14 (a)] established 15 operational teams,[1] each led by a dedicated nodal officer and supported by an assisting team. These teams, with clear responsibilities and guidelines, aimed to ensure a coordinated and comprehensive disaster response, addressing the diverse needs of the affected communities.

The 15 operational teams functioned within a unified framework, ensured seamless communication and cooperation. Chaired by the District Collector, regular coordination meetings facilitated effective collaboration across all levels. Shared resources and a centralized command structure further strengthened the integrated approach, which proved pivotal in manging the disaster. The following sectoral reports provide detailed accounts of the activities undertaken.

[1] *1. Rescue Operation, 2. Technical Team 3. Relief Camp Management, 4.Health & Special Healthcare Management Team, 5.Dead Body Management, 6.Missing People Management, 7.Migrant Labour Welfare, 8.IEC Management, 9.Volunteer Management, 10.Data Management, 11.Call Center Management, 12.Management & Distribution of Relief Materials, 13.Counseling Services, 14.Vehicle Management, 15.Waste Management*

Figure 1-14: *Operational Team Framework*



Table 1-14: *Government issued Orders related to Meppadi landslide*

Sl. No.	Government Order Number	Date	Name of the order issued department	Subject
1	G.O.(Rt) No.1391/2024/LSGD	30.07.2024	Local Self-Goverment Department	Order authorizing utilization of own resources by Local Self-Government Institutions for monsoon Disaster Relief and Rehabilitation purposes
2	G.O.(Rt)No.546/2024/ DMD	30.07.2024	Disaster Management Department (DMD)	Regarding Mundakkai, Attamala, Chooralmala Coordination of Rescue Operations in Wayanad District
3	G.O.(Rt) No.1412/2024/LSGD	01.08.2024	Local Self-Goverment Department	Order authorizing contribution to the Chief Minister's Relief Fund by Local Self-Government Institutions for Meppadi Landslide Relief and Rehabilitation purposes
4	G.O.(Rt)No.567/2024/ DMD	02.08.2024	DMD	Standard Operating Procedure (SOP) for the dignified disposal of dead bodies retrieved in Malappuram District
5	G.O.(Rt)No.566/2024/ DMD	02.08.2024	DMD	SOP for dignified disposal of dead bodies
6	G.O.(Rt)No.569/2024/ DMD	02.08.2024	DMD	Order sanctioning funds to the Wayanad District Collector for the disbursement of Ex-Gratia Payments to the bereaved families of the victims of the Meppadi Landslide
7	G.O.(P)No.1/2024/ DMD	02.08.2024	DMD	Meppadi Grama Panchayat, Kottapadi Village, Vellarmala Village and Thrikaipetta Village of Vythiri Taluk of Wayanad district is notified as disaster affected
8	G.O.(Rt)No.572/2024/ DMD	03.08.2024	DMD	SOP for the Collection of samples for DNA Profiling
9	G.O.(Rt)No.573/2024/ DMD	04.08.2024	DMD	Orders regarding dignified disposal of dead bodies
10	G.O.(Rt)No.578/2024/ DMD	05.08.2024	DMD	Notification of the formation of a Special Task Force to facilitate the timely settlement of Insurance Claims for the victims of the Meppadi Landslide

11	G.O.(Rt) No.1448/2024/LSGD	05.08.2024	Local Self-Goverment Department	Order granting relaxation in Sectoral conditions and authorizing the implementation of Relief Measures in Meppadi Grama Panchayat as per the 2024-25 Annual Plan
12	G.O.(Rt)No.580/2024/ DMD	06.08.2024	DMD	Terms of Reference (TOR) for the Special Task Force constituted to facilitate the timely settlement of Insurance Claims for the victims of the Meppadi Landslide
13	G.O.(Rt)No.579/2024/ DMD	06.08.2024	DMD	Notification for the constitution of Teams to conduct Rapid Visual Assessments of Building Liveability and Structural Integrity
14	G.O.(Rt)No.583/2024/ DMD	06.08.2024	DMD	Notification regarding arrangements for the dignified disposal of unclaimed dead bodies and body parts, and the acquisition of additional land for burial grounds in Wayanad District
15	G.O.(Ms)No.142/2024/ RD	07.08.2024	Revenue Department	Initiative to facilitate the proactive retrieval and delivery of essential certificates to the survivors of the Meppadi Landslide – 'Certificate retrieval campaign'
16	G.O.(Ms)No.143/2024/ RD	08.08.2024	Revenue Department	Order waiving fees and relaxing procedures for the issuance of duplicate/renewed documents to individuals affected by the Meppadi Landslide
17	G.O.(P)No.2/2024/ DMD	09.08.2024	DMD	Revised notification regarding the declaration of disaster-affected areas in Wayanad District following the landslide incident of 30.7.2024
18	G.O.(Rt)No.589/2024/ DMD	09.08.2024	DMD	Providing emergency financial assistance to the affected individuals of the Meppadi Landslide
19	G.O.(Rt)No.590/2024/ DMD	09.08.2024	DMD	Order appointing a committee by the State Disaster Management Authority to conduct a comprehensive assessment of land use and relocation sites and to give recommendations.
20	G.O.(Rt) No.597/2024/ DMD	13.08.2024	DMD	Order authorizing the payment of rent for providing temporary accommodation to the victims of the Meppadi Landslide
21	G.O.(Ms) No. 7/2024/ DMD	14.08.2024	DMD	Order authorizing the disbursement of financial assistance to the bereaved families and severely injured/disabled individuals affected by the Meppadi Landslide
22	G.O.(Ms)No.8/2024/ DMD	14.08.2024	DMD	Order issued for providing ex-gratia and other benefits to the dependents of those who died in the landslide along with guidelines
23	G.O.(Rt)No.625/2024/ DMD	23.08.2024	DMD	Notification Regarding the Constitution of an Expert Committee to Conduct a Comprehensive Post-Disaster Needs Assessment (PDNA) in Wayanad District
24	G.O.(Rt)No.664/2024/ DMD	06.09.2024	DMD	Order sanctioning research on landslide dynamics in the landslide-affected areas of Meppadi Grama Panchayat, Wayanad District, to be conducted by Amrita Vishwa Vidyapeetham
25	G.O.(Rt) No.5980/2024/GEDN	12.09.2024	General Education (S.C) Department	Order waiving fees and simplifying procedures for the issuance of certificates from the vocational Higher Secondary department to individuals affected by the Meppadi Landslide
26	G.O.(Rt)No.367/2024/ WCDD	13.09.2024	Women & Child Development	Order authorizing financial assistance and sponsorship for the rehabilitation of children orphaned due to the Meppadi Landslide
27	G.O.(Ms)No.120/2024/ LSGD	18.09.2024	Local Self-Goverment Department	Order prescribing guidelines for the registration of deaths resulting from the Meppadi Landslide
28	G.O.(Ms)No.11/2024/ DMD	04.10.2024	DMD	Order authorizing the construction of a Model Township for the rehabilitation of the victims of the Meppadi Landslide

29	G.O.(Ms)No.5/2024/ WCDD	05.10.2024	Women & Child Development	Order authorizing the disbursement of one-time financial assistance to children orphaned and semi-orphaned due to the Meppadi Landslide
30	G.O.(P)No.233/2024/ RD	07.10.2024	Revenue Department	Order imposing a moratorium on revenue recovery proceedings for loans and arrears in respect of individuals residing in Vythiri Taluk, Wayanad District
31	GO(Ms)No.108/2024/ AGRI	14.10.2024	Agriculture Department	Order constituting an expert committee to review the implementation of ongoing agricultural schemes, including crop insurance, emergency assistance, and farmer loan moratorium, in the context of the landslide Disaster in Wayanad district on 30.07.2024
32	GO (Rt)No.814/2024/ DMD	23.10.2024	Disaster Management Department	Order authorizing the disbursement of emergency financial assistance to the victims of the landslide in Vythiri Taluk, Meppadi Grama Panchayat, Wayanad district

The GO orders issued up to the finalization of the PDNA document have been incorporated. However, these are not the only orders issued by the state in response to the Meppadi landslide. Further orders are expected to be issued after 23.10.2024 to enhance the management of the recovery process for the Meppadi landslide.

1.15. Immediate Relief Assistance

Significant damages due to the disaster are given in [***Table 1-12***]. A Special Officer was appointed to oversee the immediate relief. State Relief Commissioner, Commissioner Land Revenue and State Project Officer, KSDMA moved to Wayanad and camped in Wayanad to aid the DDMA in coordinating relief operations.



1. Relief Measures:
   17 relief camps were started to accommodate 4102 individuals displaced by the disaster, providing essential services and support. The last camp was closed on August 25, 2024 as the inmates moved with relatives or to rental houses with government aid. The houses in the affected Grama Panchayat wards where families stayed were supplied with drinking water and essential commodities.



2. A total of 172 volunteers, including the 'Green Army' undertook disposal of bio degradable waste based on the guidelines for Waste Management in disaster affected areas prepared and published by Suchitwa Mission, Wayanad.



3. Human Fatalities:
   173 dead bodies and 2 body parts were identified and handed over to relatives. Unidentified 53 dead bodies and 212 body parts were cremated at Puthumala after collecting DNA samples for future identification purposes. 7 body parts were handed over for forensic examination. Family members of 131 individuals who lost their lives in the dis-aster were given ex-gratia of INR 4 lakhs from SDRF, INR 2 lakhs from CMDRF and INR 2 lakhs from PMNRF. Family members of 173 individuals who lost their lives in the disaster were given INR 10,000 for undertaking cremation/burial.



4. Injuries:
   630 injured were rescued and hospitalized immediately after the landslide by the rescue team. Department of Health established district-level call centers, with additional support from a state-level call center at the Directorate of Health Services in Thiruvananthapuram. The Family Health Centre in Meppadi was designated as the primary facility for conducting on-site post-mortem examinations and coordinating health care activities in the camps and field. Gratuitous relief for injured individuals has been categorized based on the severity of disabilities and the duration of hospitalization, ensuring that those most affected receive appropriate support.



5. A special document recovery drive was carried out to provide copies of documents that the affected families lost.

6. 794 families who were in relief camps were relocated to temporary housing by paying a rent of INR 6000 per month with 28 days from the date of the disaster.

7. 649 families were given back to home kits with furniture and utensils.

8. Livelihood Assistance:
   - Immediate financial assistance of INR 10000 was provided to 1013 families.
   - INR 300 per adult for up to two adults in a family totaling 1684 individuals is paid to those living outside the camp as livelihood assistance.

9. Schooling of the disaster affected 607 children was restarted at VHSS Meppadi and all the children were provided with the necessary study materials.

10. The plantation and agriculture labour restarted on the 50th day of the disaster

11. Six Children who lost two parents were given INR 10 lakhs and eight children who lost one parent were given INR 5 lakhs.

12. Psycho-social counseling is continuously given to those impacted by the disaster and to Aapda Mitra and Civil Defence Volunteers who actively participated in the rescue and relief operations.

1.16. Studies commissioned

The State Disaster Management Authority commissioned two studies as directed by the Government vide G.O (Rt) No.590/2024/DMD dated 9/8/2024, one to document the landslide event and the second to examine the affected area in detail and recommend areas where restrictions in land use must be imposed. The Geological Survey of India prepared the first investigation report. The first study was authorized to be conducted by IISER Mohali and the University of Kerala under the joint leadership of Dr Yunus Ali P and Dr Sajin Kumar K. S.

The second study was authorized to be conducted by a joint team of Mr John Mathai, Scientist (G) (Rtd), National Centre for Earth Science Studies, Dr Drissia T. K, Principal Scientist & Head, Centre of Excellence in Water related Disaster Management, Centre for Water Resources Development and Management, Dr Sreevalsa Kolathayar, Associate Professor, Dept. of Civil Engineering, NIT Surathkal, Ms Thara Manoharan, District Soil Conservation Officer, Wayanad, Mr Pradeep G. S, Hazard & Risk Analyst, KSDMA & Convenor Landslide Advisory Committee of KSDMA and Mr Shinu A, GIS Technician, Risk Lab, Kerala State Emergency Operations Centre. In addition, an independent study was conducted Dr Maneesha Vinodini Ramesh, Provost of Amrita Vishwa Vidyapeetham who is also a member of the Landslide Advisory Committee of KSDMA to understand the causative factors that led to the landslide (https://online.pubhtml5.com/ppfdc/icdr/). This document relies on the above studies, the recommendations therein and the field assessment and expertise of the members of the PDNA team.

1.17. Structural and Geological Profile of the landslide

Bedrock Composition:

The area predominantly features biotite hornblende garnetiferous gneiss with charnockite enclaves.

Joint and Discontinuity Patterns:

Three sets of discontinuities/joints were observed [***Figure 1-16***]:

1. A North-South (N-S) trending joint on the left flank, gently dipping (<10 degrees) towards the channel in the East direction, and on the right flank, gently dipping (10 degrees) towards the channel in the West direction.
2. A vertical N-S trending joint along the channel.
3. An East-South (E-S) trending vertical joint across the channel.



Figure 1-15: *View of the river bed before (a) and after (b) the landslide [Yunus et al., 2024; Photo courtesy Shagin Sunny (a) and Vishnu KM (b)]*

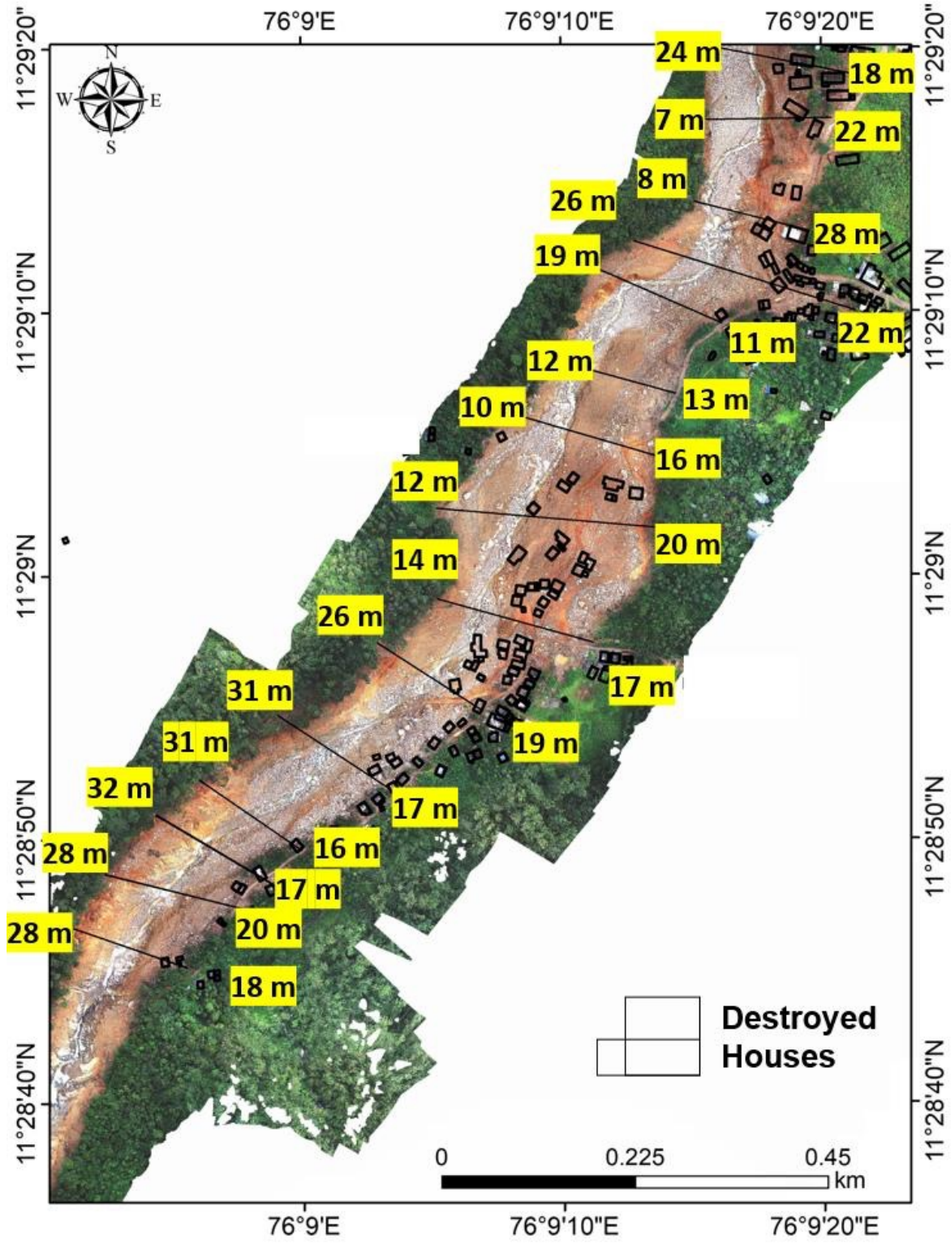


Figure 1-16: *Estimated runup heights along Punnapuzha River (Yunus et al., 2024)*

Figure 1-17: *Joint/discontinuity patterns visible along Punnapuzha River*



Figure 1-18: *Landslide release area*



Discontinuity Spacing:

The spacing of discontinuities is large, contributing to forming large rock blocks and boulders.

Release Area:

A rock wedge was identified in the release area, characterized by a substantial overburden of debris and clay-rich soil material [***Figure 1-17***]. The release area is part of the Meppadi forest range (South Wayanad Division) under Vellarimala vested forest.

The release area comprises in-situ gneissic rock overlain by weathered fractured rock and overburden material. The thickness of overburden material in the release area is comparatively less than that on the channel banks.

Flank Stability:

- The left flank of the wedge has failed, carrying overburden material and rock blocks.
- The right flank appears intact from a distance and covered with forest; however, a significant amount of loose overburden, debris material, and fractured, weathered rocks remain, posing a risk for future release.

Channel Characteristics:

The channel follows the axis of the wedge intersection.

Material Mobilization:

The landslide mobilized material, including rainwater, spring water, uprooted trees, tree logs, rock boulders, and debris, from the release area along the channel. The release area is characterized by thick forest cover, contributing to the mobilization of vegetative debris. Entrainment along the channel and bank erosion contributed significantly to the enormous material mobilization during its flow.

Slope Observations:

- From the release area to Punchirimattam, the slope is steep (possibly more significant than 40 degrees).
- Between Punchirimattam and Mundakkai, the slope is moderate (possibly 20-30 degrees).
- From Mundakkai to Chooralmala, the slope is gentle (possibly less than 15 degrees).

Erosion Patterns:

Significant erosion is observed on both the channel's banks, especially on the left bank. The bank slopes are currently steep, ranging from sub-vertical to vertical (more than 60-70 degrees), with thick overburdened debris material (soil and rock fragments) of 20-40 meters in height.

In many places, giant boulders are seen embedded in the overburdened material in the banks.

Landslide Dam Formation:

Field observations and local community reports indicate multiple landslide dam formations may be inferred during the debris flow/torrent process. Indicators of such dam formations include:

- Eyewitness reports from residents during post-disaster interactions.
- There is a substantial difference in flow heights between upslope and downslope areas at probable landslide dam sites.
- Observed flow and backflow heights along the bank slopes, indicating backflow conditions.
- Observed flood levels mud markings on the tree trunks on the banks.

Probable Landslide Dam Locations

The landslide dam locations may be seen in ***Figure 1-18***.

a. Punchirimattam -Top area:
In-site competent rock exposures are sufficiently close to restrict the channel width to a very narrow passage (~5-7 m), suggesting the potential formation of a landslide dam.

b. Near Vanarani estate bridge:
As reported by the local community, the Vanarani bridge was approximately a 15-meter-long reinforced cement concrete (RCC) bridge with a height of approximately 5 meters above the channel. The bridge has been washed away in the recent debris flow event. They also reported that the past flood (2020) along this channel had also blocked the bridge with tree logs and transported material.

c. Near Mundakkai Waterfall with Seethammakund:
The topographical conditions, with competent in-situ rock and a narrow channel, were favourable for landslide dam formation. The Seethammakund area has been obliterated, indicating changes in the channel floor.

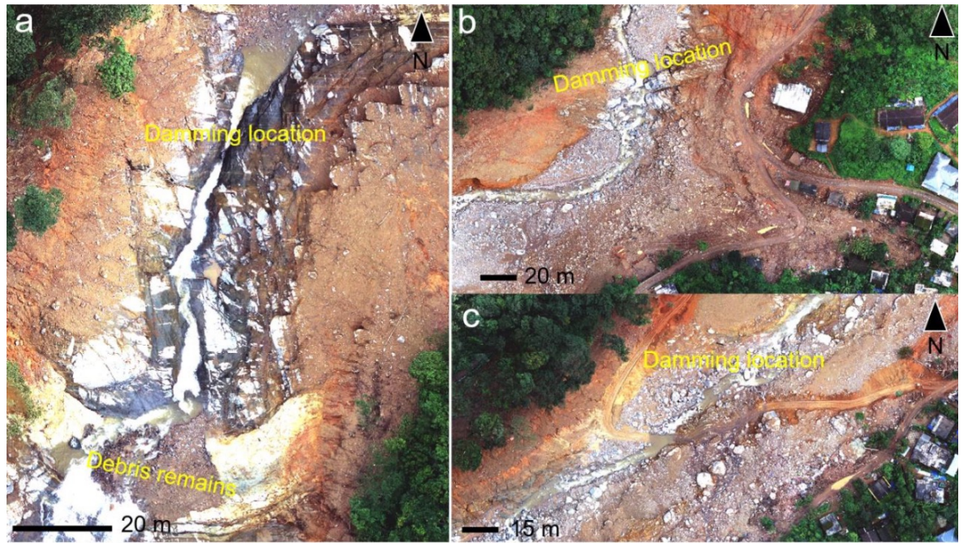


Figure 1-19: *Probable locations of landslide dams as seen from field evidence (Yunus et al., 2024)*

1.18. Possible sequence of events on July 30, 2024

1. As per the local inquiry and drone images, multiple landslides have occurred in the release area. Muddy water and tree trunks were observed on the downstream side around 11:45 P.M on July 29, 2024. Local community members also reported the occurrence of such slides on July 29th, (https://youtu.be/a9hBEc833ww). This indicates that minor slides have started in the catchments during this time. The first significant slide in the source zone leading to flow later might have occurred between 12.00 midnight and 01.00 A.M.

2. Kalladi rain gauge station operated by IDRB received 200.2 mm of rainfall on July 29th, followed by 372.6 mm on July 30th. This intense and sustained rainfall significantly saturated the soil and increased the hydrostatic pressure within the slopes of Punchirimattam Hill. The locals also reported that massive winds were there for nearly a week before the landslide. The initial debris slide led to the accumulation of rocks, soil, and vegetation, temporarily blocking the channel, and forming landslide dams at multiple locations. Further saturation by rain and spring water later turned this slide into a massive debris flow with debris and vegetative materials.

3. The first probable landslide dam [***Figure 1-19,a***] likely formed near Punchirimattam due to the constriction of the channel by in-situ competent rock, reducing its width to about 5-7 meters. Punchirimattam area, located at about 1100 m AMSL, indicated several damaged houses on the right bank segment. The high-water mark crossed several places beyond the 30 m buffer zone from the stream edge. A mount is seen in the area, and the structures and vegetation are stripped off. This also falls in the unsafe zone. A bridge in this locality has been washed off. The left bank segment is covered with natural vegetation and hosts a cardamom plantation. The extent of loss of land is limited to a thin strip along the river bank. A quick examination indicates a ponding effect due to constriction in the river channel, causing the diversion of debris-laden water to the right bank. The breaching of this probable landslide dam may be correlated to the reporting of locals as hearing of a fair sound at around 00:30 A.M on July 30, 2024.

4. The Vanarani Bridge, located between Punchirimattam and Mundakkai at an elevation of 1001.09 meters, was identified as a probable site of the second landslide dam [***Figure 1-19,b***]. The submerged area around the bridge rose to an approximately estimated 30-40 meters above the channel level, indicating significant blockage. High bank erosion is observed on the left bank of the Vanarani estate. The damming effect is also suspected at the Punchirimattam-Vanarani bridge. Around 01:30 A.M, the locals reported a huge sound, which could be correlated with the breach of this landslide dam.

5. As water accumulated behind the second landslide dam, the pressure increased, eventually leading to their rupture. This released a surge of water and debris downstream, probably causing the formation of a subsequent third landslide dam. This may probably be correlated to the landslide dam near Seethammakund waterfall across the Mundakkai settlement [***Figure 1-19,c***]. Around 03:30 A.M, the locals heard another sound and could feel the vibration in their houses. This report also supports the breach of this landslide dam. The Seethammakund area in Mundakkai, at an elevation of around 945 meters, was observed to be a backflow zone. The high-water levels in this area suggest that water and debris from the ruptured dams were backing up, further contributing to local flooding and the accumulation of materials. The stream flow steadily increased, becoming muddy and bringing lots of wooden logs.

6. The debris flow energy began to dissipate significantly at Chooralmala due to the change in topography. The flatter terrain provided a wider area for debris to spread and accumulate, reducing the velocity and energy of the flow and affecting habitations on the banks. This area acted as a natural basin, allowing the material mass (boulders, debris, and tree logs) to settle. The backwash of the debris flow from Punnapuzha

went upstream in Padavettipuzha, another tributary joining the Punnapuzha river. The stream breached its banks near the confluence of these two streams, and the saltation load and bed load of large boulders were deposited in the residential area along the school road and the river bank [***Figure 1-20***]. The deposits of large boulders and cobbles can be seen as far as one kilometre downhill from this bank breach point up to the Vellarmala School.

7. As both streams coalesced and flowed down further, considerable damages occurred on both sides of the Padavettipuzha. The river bank erosion has resulted in significant widening of the streams from 20 to 30 m to 200 to 300 m at places.

8. Beyond the current Bailey bridge, the joining rivulet area accumulated significant tree logs and transported soil, indicating ongoing backflow conditions. The water ponding level in this area was observed to be approximately 3 meters.

9. The Chooralmala Bridge (which was existing near to the current Bailey Bridge) initially blocked debris, helping to dissipate energy and contain the flow within Chooralmala. This prevented the debris flow from causing extensive damage downstream. However, the bridge eventually breached, releasing accumulated water and lowering flood levels at Chooralmala, mitigating the potential for more severe local devastation. A couple of places were affected by backlash. Terrible destruction was observed in those areas in Chooralmala.

10. Around 05:00 A.M, water started receding. The effect of the debris flow was minimal between Soochipaara and the d/s of Bailey Bridge at Chooralmala. In this area, the impact of flood was dominant over debris flow. As the debris flow continued downstream past Chooralmala Bailey bridge, it encountered a major S-shaped meandering. Here, the flow spread out, leading to minor flooding and limited bank erosion. The flood level was observed to be 2-3 meters above the riverbed, indicating that the energy of the flow had dissipated significantly by this point.



Figure 1-20: *Bank breach point and deposition of saltation load and bed load on the left bank of Padavettipuzha along Chooralmala School Road marked with yellow arrow (Maneesha, 2024)*

1.19. Possible causes of the disaster

As per the available information and field observations, the seismo-tectonic and anthropogenic causes can be ruled out for this debris flow disaster (Yunus et al., 2024). The major triggering factor for this disaster may be attributed to heavy rainfall.

Based on the field observations, the possible causes of the landslide may be inferred as follows:

1. The crown portion was covered by a substantial thickness of overburden of debris and clay-rich soil with thick forest cover, which likely has contributed to the failure.

2. Highly weathered and fractured bedrock of biotite hornblende garnetiferous gneiss with charnockite enclaves, which have inherent weaknesses.

3. Presence of three sets of joints/discontinuities with moderate to high spacing make the rock mass blocky with medium to large boulders.

4. The release area was identified with a rock wedge due to unfavourable joint sets. The left flank of the wedge has failed.

5. The steep slope from the release area to Punchirimattam, combined with moderate and gentle slopes further downstream, contributed to the speed and extent of material mobilization.

6. The heavy rainfall on July 29-30, 2024 must have triggered the wedge failure in the steep slope at the crown dislodging the rock mass, debris, and vegetation with tree logs.

7. The huge quantity of rain water and the water from the springs at the catchment of the crown must have mobilised the dislodged rock mass, debris with finer soils and tree logs in the form of a debris flow down slope.

8. Following the wedge intersection axis, the channel characteristics facilitated the mobilization of material, including rainwater, spring water, uprooted trees, tree logs, rock boulders, and debris.

9. The material volume got added up on the transportation path of the debris flow as entrainment from the main channel of flow and as bank erosion from side slopes. The side slopes were having an overburden debris material of the order of 30-40 m height and hence, the bank erosion contributed much to the debris flow in terms of debris material and trees.

10. Along the flow track, a huge amount of water only got added up to the debris flow process from many lower order drainages joining the main flow channel.

11. Presence of thick shear zones across the channel of the order of 1-2 m with gauge material at many locations in the initiation zone have also contributed to the process.

12. The formation of multiple landslide dams during the debris flow process, as seen evident during field visits and reporting by residents, further complicated the situation. This led to the accumulation of slurry and tree logs, raising the level of accumulation, back flow into lower order drainages and subsequent dam breaches that exacerbated the devastation in damaging the buildings and other infrastructures, vegetation, and agriculture, burying and taking away everything on its path including the lives and infrastructures.

1.20. Future hazard and risk assessments

1. At the crown, the left flank of the wedge has already failed, and the right flank of the wedge is presently intact but contains highly fractured and weathered rock mass overlain by loose overburden debris material (fine soil with gravels) and forested vegetation. The right flank of the rock wedge in the release area, with a significant overburden cover of debris and clay-rich soil, indicates potential instability and poses future risk of failure with great concern [Figure 1-20]. The wedge could fail, especially under heavy rainfall, leading to further landslides.

Figure 1-21: *Debris deposited on the channel bed*



2. Significant erosion on both banks of the channel, standing with steep slopes (60-70 degrees) and high overburden material (20-30 meters), have signs of sliding with prevailing tension cracks in and around Punchirimattam and Mundakkai area, specifically on the left bank. This poses a risk of further bank collapse. This could contribute to additional landslides leading to channel blockages at places.

3. Huge deposition of mobilized material including uprooted trees, rock boulders, and debris, specifically on the right bank in and around Punchirimattam and Mundakkai area indicates a high potential for slope failure and erosion during heavy rains.

4. Huge deposition of mobilized material including uprooted trees, huge rock boulders, and debris, specifically on the channel bed in and around Chooralmala area indicates a high volume of material availability for erosion during heavy rains.

5. Changes in the landscape have significantly impacted local wildlife habitats and biodiversity, potentially increasing the risk of human-elephant conflicts. As natural habitats are disrupted, elephants may venture closer to human settlements in search of food and shelter, leading to dangerous encounters.

1.21. Recommendations for the landslide affected area

Based on the insights gathered from the local community, administration and field assessments, the following recommendations are proposed to enhance disaster risk management and to promote resilience in the affected regions:

No-go zones

1. The recommendations put forth by the expert committee, as articulated in the Kerala State Disaster Management directives [GO (Rt) No. 590/2024/DMD dated 9/8/2024 and MTO I/1550/2024/Admin dated 11/08/2024], must be strictly adhered to. These recommendations identify areas around Punchirimattam and Mundakkai as high-risk zones, necessitating the enforcement of designated no-go areas to prevent future hazards.

2. It is recommended that the entire affected area, particularly around Punchirimattam and Mundakkai, be officially designated as no-build and no-habitat zones due to the imminent risk of landslides and failures. Furthermore, a buffer zone along both banks of the river should be established as a no-go zone, prohibiting any development or human activities within these unsafe areas [***Figure 1-22, 1-23, 1-24, 1-25, 1-26,1-27***].

3. Essential public infrastructure in the no-go zone, such as schools, post offices, police stations, and community halls, are recommended for relocation and reconstruction in safer locations nearby such that Chooralmala area do not eventually become a permanent fallow. Such structures and habitations in Chooralmala area shall be beyond the no-go zones identified by the expert committee.

4. The landslide impacted families, houses and Medium, Small and Micro Enterprises (MSMEs) shall be relocated to safer areas.

5. The families, houses and MSMEs that will have to be relocated owing to the implementation of no-go zones should also be considered for relocation to safer areas.

6. Those families, houses and MSMEs which are probably not in the no-go zone, but may be isolated owing to relocation of houses in no-go zone may also be considered for relocation to safer areas.

7. The no-go zones shall be a temporary fallow used only for eco-restoration using deep rooting grass or tree species for at least 10 years, after which appropriate agriculture may be permitted without permanent human habitation.

8. Every building that is falling in the no-go zone and buildings of those who are relocated to safer areas shall be demolished such that these building is not put to use for other uses as such as home stays or resorts.

Monitoring Interventions

1. Monitoring Steep Slopes: The steep slopes from the release area to Punchirimattam (greater than 40 degrees) pose a high risk for further landslides. Although moderate and gentle slopes downstream reduce this risk, continuous monitoring is essential. Necessary cameras including infra-red cameras may be adequately located to capture real time behaviour of the area and streamed to the Panchayat office and Taluk EOC.

2. It is appropriate to deploy an Automatic Weather Station at Mundakkai/Punchirimattam area in one of the estates for continuous monitoring of rainfall in the area.

3. A stream gauge may be established at the weir of Irrigation department, downstream of Chooralmala for continuous gauging of Padavetti Puzha.

4. Topographic hollows inside forest, particularly along the bed rock and soil/regolith abutments, there is high building of soil and resultant instabilities. The Forest Guards may be trained to identify such instable conditions as part of their usual field visits and report such probabilities for appropriate interventions by the Forest Department.

5. The Grama Panchayat, Village Office and

Tahasildar's Office may be provided with additional communication systems including Satellite Phone and eventually Low Earth Orbiting Satellite based communications such as One Web, Kuiper etc.

Hydrological Management

1. The destruction and washing away of bridges (e.g., Punchirimattam Bridge, Mundakkai Bridge, and Chooralmala Bridge) emphasize the vulnerability of existing infrastructure to landslide-induced flows and floods. Future designs should consider these extreme events, employing robust materials and construction techniques to withstand high-impact forces.

2. It is essential that causeways are avoided and that bridges do not have pillars inside the stream bed. Tress bridges or arch bridges that are adequately above the maximum flood level ascertained through ungauged catchment equations as prescribed by appropriate IS Codes shall alone be constructed.

3. Every stream crossing structure, whether a bridge, causeway, culvert, weir, or check dam, shall be structurally designed based on hydrological modelling before administrative sanction is given. Undesigned civil structures shall not be permitted within the river beds.

4. Checklist for detailed natural disaster impact assessment approved as Government Circular DMB1/82/2023/DMD dated 18-12-2023 shall be specifically filled and included in every project proposal funded by Government funds that is approved for implementation (https://tinyurl.com/DMCk-list) in this area.

5. The removal of deposited debris and large boulders along the channel, particularly in the Chooralmala area, should be conducted based on hydrodynamic studies of channel flow by the committee constituted vide GO (Rt) No. 636/2024/DMD dated 31-08-2023. Additionally, straightening the channel course at meandering portions can streamline water flow and shorten the flow path.

6. Engineering interventions such as river lining using boulder gabion walls are recommended. These flexible and breathable structures, made from locally available boulders which are part of the disaster debris, can minimize bank erosion, and facilitate proper water channelization from slope materials and springs to the main channel.

Environmental Restoration

1. Eco-Park Development: The area between the river and the School Road that is identified as no- go zone may be developed as an Eco- Park with the joint ownership of the local self-government and the individual families who owns the land parcels therein. This park may cultivate natural species of grass (Vetiver, Lemon Grass etc.) and trees for various eco-restoration projects in Wayanad.

- For developing the Eco-Park, the boulders, cobles, and pebbles that accumulated in the area should be removed.

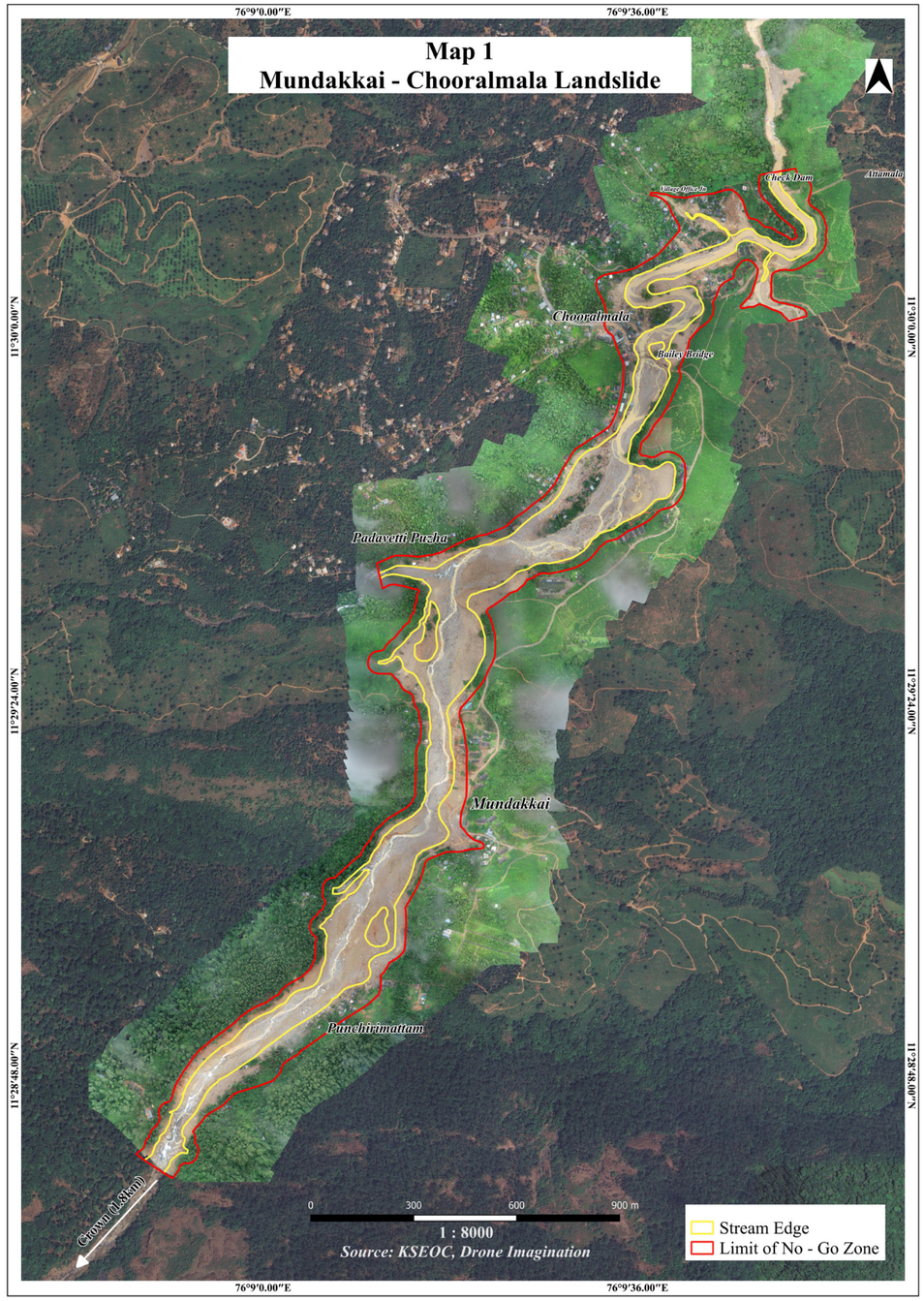


Figure 1-22 *Unsafe (no-go zone) areas along the Meppadi landslide marked within the red boundary line*

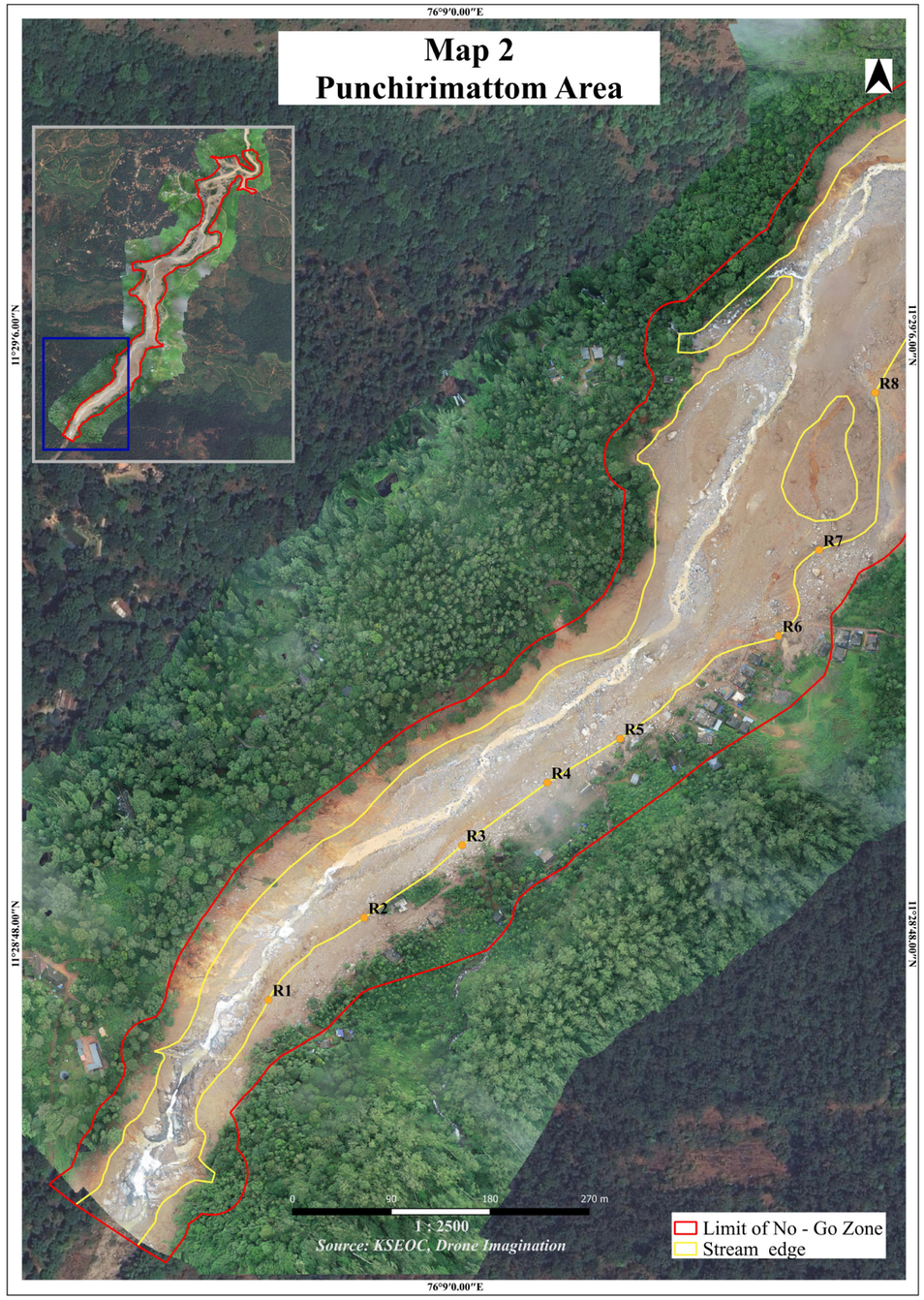


Figure 1-23 *Unsafe (no-go zone) areas in the vicinity of Punchirimattam marked within the red boundary line*

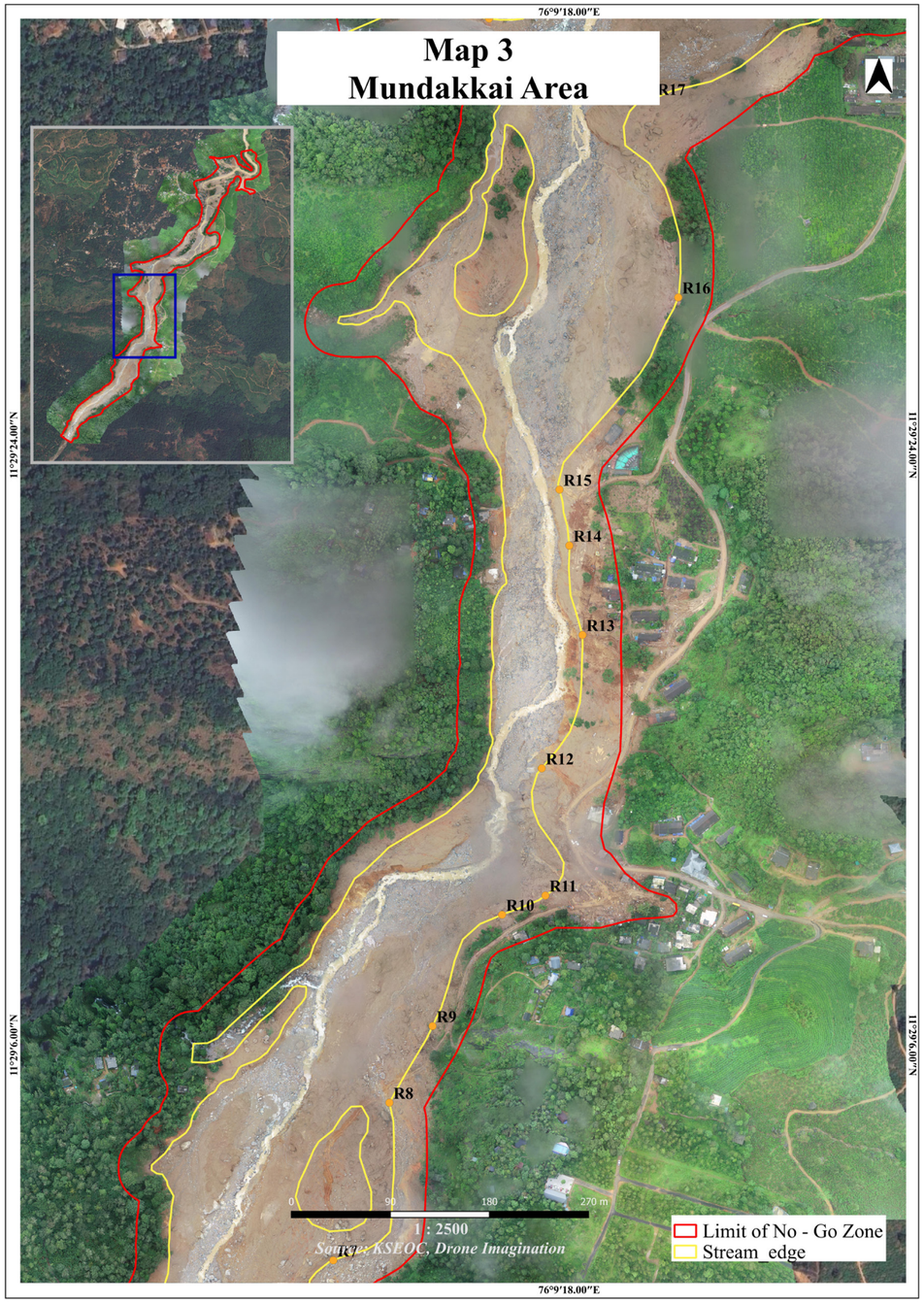


Figure 1-24 *Unsafe (no-go zone) areas in the vicinity of Mundakkai marked within the red boundary line*



Figure 1-25 *Unsafe (no-go zone) areas in the vicinity of the Punnappuzha - Padavettipuzha confluence marked within the red boundary line*



Figure 1-26 *Unsafe (no-go zone) areas in the vicinity of Chooralmala marked within the red boundary line*



Figure 1-27 *Unsafe (no-go zone) areas in the vicinity of Bailey Bridge and Gauging Weir marked within the red boundary line*

Establishment of a Landslide Living Lab

1. To commemorate the event and foster research, a portion of the landslide debris and impacted buildings should be preserved and transformed into a living lab. This facility, funded by the State Disaster Mitigation Fund and maintained by the Local Self-Government, will utilize advanced technologies such as Artificial Intelligence, Virtual Reality, and Augmented Reality to recreate the scale and impact of the landslide. It will also serve as a repository of digital archives pertaining to landslide risk reduction, making it a valuable knowledge hub for future research and planning.

   The Wenchuan Earthquake Memorial and the Great East Japan Earthquake and Nuclear Disaster Memorial Museum can serve as models for this initiative. Intact school buildings, subject to rigorous structural evaluation, can be retrofitted to house the living lab.

2. The living lab may also have specific training programs offered to Civil Defence and Aapda Mitra volunteers in early detection of landslides, remedial measures, response, and relief. The lab may collaborate with the Eco-Park and also train masons and engineers in Nature Based Solutions for landslide and erosion prevention.

3. As part of the Living Lab, the Meppadi Grama Panchayat shall also be adequately financed for the construction of a Relief Shelter to accommodate up to 1000 individuals at a carefully selected site with easy access.

1.22. Recovery vision

The recovery vision for the Meppadi landslide Disaster 2024 (on 30th July) envisions a holistic and resilient transformation focusing on:

1. **Integrated communication for risk informed practices:**
   Foster collaboration and communication between government agencies, IAGs, NGOs, private sector and local communities, pooling resources, and expertise for a coordinated and sustainable recovery effort.

2. **Mainstreaming Disaster Risk Reduction in Development Planning:**
   Review and update existing policies related to disaster management, land use and environmental protection, adapt to changing conditions and enhance resilience against future disasters.

3. **Community Centered Reconstruction:**
   CCR is a development approach that puts affected communities at the heart of the recovery and rebuilding process. It prioritizes the needs, aspirations, and capacities of local people, empowering them to take ownership of their reconstruction efforts.

4. **Technology Integration for Early Warning:**
   Enhance and expand early warning systems through the integration of cutting-edge technologies, providing timely alerts and ensuring effective preparedness for future disasters.

This recovery vision aims not only to rebuild Wayanad but also to create a more resilient and sustainable future, fostering a sense of community empowerment and environmental stewardship.

1.23. Specific recovery objectives

- **Infrastructure Rehabilitation:**
  Prioritize the reconstruction of damaged roads, bridges, and buildings to restore connectivity and essential services for the rest of the communities.

- **Community Resettlement and Housing:**
  Develop a plan for the safe and sustainable resettlement of displaced families, ensuring access to adequate housing and basic amenities.

- **Livelihood Restoration:**
  Implement programs to revive local economies, supporting farmers, businesses etc., affected by the landslide, debris flow and flooding.

- **Healthcare Strengthening:**
  Enhance healthcare facilities and services in the region, addressing immediate health needs and building resilience against potential disease outbreaks.

- **Education Recovery:**
  Rebuild damaged schools and educational institutions, providing resources for students and teachers to resume learning activities.

- **Environmental Rehabilitation:**
  Undertake initiatives for watershed management, soil conservation and afforestation to reduce the risk of future such events and enhance environmental sustainability.

- **Community Empowerment and Training:**
  Conduct training programs to educate communities on disaster preparedness, early warning systems, and response strategies, empowering them to handle future emergencies effectively.

- **Technology Integration:**
  Integrate advanced technologies for early warning systems, monitoring, and data analysis to improve disaster preparedness and response capabilities.

- **Government Policy Review:**
  Evaluate existing land use, construction, and environmental protection policies to enhance resilience and mitigate future disaster risks in Kerala.

1.24. Recovery principles

- **Community - Centric Approach:**
  Prioritize the active involvement and empowerment of local communities in decision making processes to ensure that recovery efforts align with their needs and priorities.

- **Sustainability and Resilience:**
  Embed principles of sustainability in recovery projects, focusing on eco-friendly infrastructure, resilient urban planning, and long-term environmental conservation.

- **Inclusive Recovery:**
  Ensure that vulnerable groups, such as tribes, women, children, differently abled and elderly, are addressed explicitly in recovery plans, with targeted support to meet their unique needs.

- **Partnership and Collaboration:**
  Foster collaboration between government agencies, IAGs, NGOs, private sector and international organizations to pool resources, and expertise and ensure a coordinated and effective recovery effort.

- **Transparency and Accountability:**
  Maintain transparency in resource allocation, project implementation, and decision-making processes and establish mechanisms for accountability to build trust among stakeholders.

- **Innovative Technology Integration:**
  Embrace innovative technologies for efficient data collection, early warning systems, and information dissemination to enhance preparedness and response capabilities.

- **Cultural Sensitivity:**
  Respect and integrate local cultural practices, beliefs and traditions into recovery efforts, recognizing their importance in fostering community cohesion and resilience.

- **Adaptive Planning:**
  Develop flexible and adaptive recovery plans that can evolve based on changing circumstances and emerging challenges.

- **Capacity Building:**
  Invest in training and skill development programs for local communities, local officials, and responders to enhance their capacity to cope with and respond to future disasters.

- **Risk Reduction and Preparedness:**
  Integrate risk reduction measures into recovery plans, emphasizing early warning systems, land use planning and infrastructure design that mitigate the impact of future landslides and debris flow including flooding.



SOCIAL SECTOR



02



Housing and Settlements

2.1. Basic Profile of the Sector

Meppadi Grama Panchayat is one of the local bodies of Wayanad and is situated at an altitude of over 700 meters above the Mean Sea Level. The Grama Panchayat, nestled in the Western Ghats, is characterized by its hilly terrain. Approximately one-third of the Panchayat's area is mountainous, with Vellarmala being a prominent feature. The landscape is predominantly composed of small hills and valleys. The unique geographical setting along with its salubrious climate, rich history and climate, makes Wayanad an entity which projects itself as a unique tourism product. The land use pattern in Wayanad District is predominantly dominated by forests and plantations, which together account for roughly 80% of the total land area. Agricultural land occupies approximately 10% of the land, while the remaining 10% is allocated for residential and infrastructural development. As a result, the population has concentrated in low-lying areas, leading to high-density settlements. The predominant housing types in the area are traditional masonry houses with tile roofs ('padis' construction) and modern RCC roofed houses.

Masonry Buildings: 'Padis' Construction (Titled Roofing System / Line Quarters)

The affected area is an old plantation settlement primarily consisting of traditional "Padis" or line quarters, where multiple families resided in row houses. Over time, these plots have seen the construction of single-storey tile-roofed houses. These structures, typically built with red bricks and tile roofs, are characterized by low height and limited openings. The foundations and plinths are constructed using rubble masonry, while the walls are made of locally available burnt clay bricks or laterite blocks. The roofs are supported by wooden rafters and purlins and covered with Mangalore tiles.

The doors and windows were constructed using locally available wood, with limited openings in the walls. In addition to the "Padis," there were also individual single-family houses with tiled roofs. These houses shared similar construction techniques of the "Padis" but were generally larger in size.

Masonry Construction (RCC Roofing System)

The foundation of these load-bearing masonry structures typically consists of rubble stone masonry, extending 750-900 mm below the natural ground level. To ensure structural integrity, all walls are reinforced with 150 mm thick RCC bands at the plinth and lintel levels. The superstructures (walls) are constructed using locally available materials, such as laterite, concrete blocks, or burnt clay bricks, laid in cement-sand mortar with a thickness of 200 mm and finished with 15 mm thick cement-sand (1:6) plaster.

Door and window frames are commonly made of RCC or wood, with RCC 'chajjas' provided over openings. The roofing options vary, including RCC flat or sloping roofs, CGI roofing sheets, or traditional thatched roofs. For aesthetic appeal, most buildings are finished with putty both internally and externally, and the floors are predominantly covered with vitrified or ceramic tiles. Compound walls or retaining walls, along with gates, are also constructed for most buildings, adhering to the required setbacks as per local bylaws. Overall, the construction practices and material quality in the affected area are generally good.

Existing Building Materials & Technologies

The affected areas of Punchirimattam, Mundakai, and Chooralmala are hilly regions situated



Figure 2-1: *Padis – Line Quarters (before landslide)*

700 meters above sea level and approximately 10 kms from the nearest town of Meppadi. Due to the ban on quarrying in Wayanad District, construction materials are primarily sourced from neighboring districts, requiring transportation over a distance of around 100 kms. This, coupled with the reliance on migrant workers from other states, significantly increases construction costs in the affected area.

For instance, laterite blocks, sourced from Kannur District, cost INR 57 per block at the construction site. A more recent trend involves the use of 7-inch solid concrete blocks, which are slightly more economical at INR 48 per block, including transportation costs. Additionally, precast concrete doors and window frames, manufactured locally, are being adopted in the area. Construction materials like coarse aggregate, fine aggregate, cement, and steel are generally procured from Kozhikode District, further contributing to the high costs due to transportation.

2.2. Sectoral Policies

Housing Policy and Enforcement

Kerala Panchayat Building Rules (KPBR) govern the construction of residential buildings in the Meppadi area. Most buildings have obtained necessary building permits from the Panchayat, while smaller structures under 100 sq. m. were constructed with a No Objection Certificate (NOC) as per the building rules. Recognizing the unique geological conditions of Wayanad, particularly its susceptibility to earthquakes and landslides, the Kerala State Disaster Management Authority (KSDMA) issued orders in 2015 under the Disaster Management Act, 2005. These orders have imposed restrictions on construction activities in the district, limiting buildings in Meppadi Grama Panchayat to a maximum of 3 floors or 10 meters in height.

Following the Puthumala and Muttil landslides in 2019, additional restrictions were imposed, further limiting construction in high-hazard zones and areas within a 500-meter buffer zone, as delineated in the landslide zonation map prepared by the District Disaster Management Authority (DDMA). Portions of Meppadi Panchayat were included in these restricted zones. These regulations have played a crucial role in mitigating the impact of disasters, particularly landslides, by effectively controlling construction activities in the vulnerable areas.

The initial landslide severely damaged the bridge connecting Punchirimattam-Mundakkai to Chooralmala, significantly hindering rescue efforts and contributing to loss of life. Additionally, the road linking Chooralmala to the district headquarters and nearby hospitals was severely compromised. To address these critical issues, there is an urgent need to establish safe and accessible routes, such as all-weather roads or alternative connectivity options, to reconnect affected communities with essential services like hospitals, fire stations, and schools.

A comprehensive, 15-20-year risk-informed master plan is crucial to enhance the resilience of buildings, water bodies, sanitation systems, waste management infrastructure, power supply, road networks, and other vital facilities. In Meppadi Panchayat, strict adherence to the



Figure 2-2: *Prevalent Laterite Block used in housing construction*



Figure 2-3: *Solid concrete blocks used in practice in Meppadi Panchayat*

Figure 2-4: *Precast concrete door and window frames manufacturing unit in Meppadi Panchayat*



Kerala Panchayat Building Rules (KPBR)-2019 is essential throughout all phases of construction, from planning to completion.

2.3. Disaster Impact

Housing stock, typologies, and causes of damages

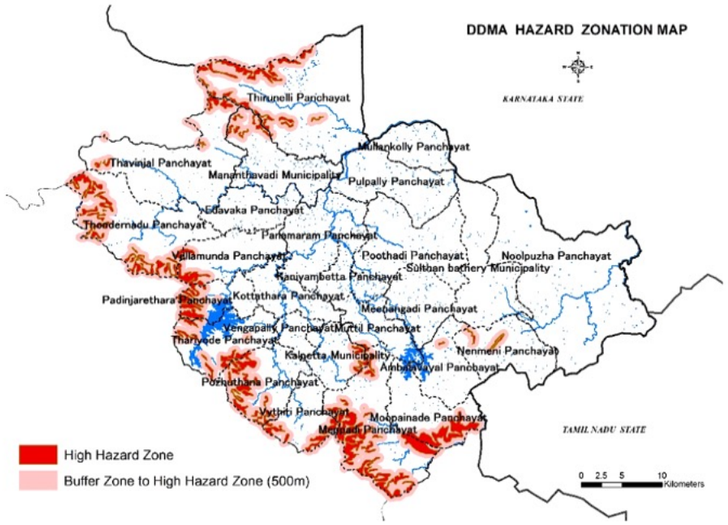
The flood and landslide impacted the Meppadi Grama Panchayat within Vythiri Taluk, specifically Wards 10, 11, and 12 (Chooralmala, Mundakai, and Punjirimattam). Encompassing a land area of 125.94 sq. kms, the Panchayat has a population of 37,785, translating to roughly 300 residents per sq. m.

The affected region primarily features load-bearing construction, evident in its 2,007 housing units. These units are predominantly single-story (1,943), with a smaller number of two-story (63) and one three-story structure. All buildings are classified as "pucca" constructions, featuring RCC (reinforced cement concrete) and CGI sheet or tiled roofing systems. Notably, the masonry work utilizes laterite blocks, concrete blocks, or burnt clay bricks, incorporating seismic-resistant measures such as horizontal RC bands at both plinth and lintel levels.

The moderate buildings sustained damage in varying degrees, primarily due to the impact of large timber logs and stone rubble blocks during landslides, debris flows, and flooding. These impacts resulted in significant damage to both the "Padi" structures and individual single-family residences, ranging from partial to complete destruction. The observed damages include out-of-plane bending or overturning of walls, cracks in walls, collapse of roofing systems, damage to plinth masonry, soil erosion beneath foundations, wall subsidence, and the deposition of mud or debris up to the sill level. Even partial damage to the "Padi" structures compromised their structural integrity, rendering them uninhabitable.

To assess the extent of loss and damage, the Public Works Department (PWD) has categorized the buildings into four categories based on their plinth area, as outlined in the Damage Severity Rating (DSR) guidelines.

Figure 2-5: *Landslide Zonation Map of Kerala State*



Class A: Buildings with brick or stone masonry in lime or cement mortar with RCC or tiled roof over good quality teak of wood and RCC-framed structure.

Class B: Buildings with brick or stone masonry in mud mortar or laterite in lime mortar with tiled AC or GI sheet roofing over country wood or steel

Class C: Buildings with sun-dried brick or laterite in mud mortar with country wood over tiled AC or GI roofing.

Class D: Building with mud wall, and thatched roof over country wood or bamboo rafters etc and temporary sheds thatched buildings of inferior type construction.

The damages observed included roof collapse, cracks or overturning of load-bearing walls, separation of perpendicular walls, damage to windows and doors, and foundation and wall settlement. These damages were primarily caused by the impact of debris flows, wooden logs, stones, and other debris. As a result, both structural and non-structural elements of the buildings were severely compromised, rendering them unsafe for further occupancy or use.

Impact on Housing Sector

The recent landslide-debris flow and flash flood disaster in Meppadi, Wayanad, has had a devastating impact on the region's housing sector and community life. A significant number of residents have lost their homes, forcing many families, including those with elderly individuals, women, and children, to seek shelter in temporary accommodations like relief camps, rented houses, or with relatives in nearby villages. This displacement has disrupted their daily lives and livelihoods.

As the majority of the population in Meppadi relies on agriculture, the disaster has dealt a severe blow to their livelihoods. Over 111 farmers have lost their cattle sheds, compounding their difficulties.

The reconstruction of homes poses significant challenges due to the limited availability of construction materials and skilled labour in the area.

Impact on People

The devastating impact of the landslide on housing has significantly affected the livelihoods of many residents, who are now living in temporary shelters.



Figure 2-6: *Houses affected by Meppadi landslide*



Figure 2-8: View of severely damaged buildings

This displacement has disrupted their daily lives and routines.

Additionally, the landslide temporarily disrupted schooling, negatively impacting the quality of education for students. Women, orphan children, and the elderly are particularly vulnerable during the disaster. Women, in particular, faced additional challenges in managing household responsibilities while adjusting to the temporary living situation.

2.4. Damage Assessment

A team comprising housing experts, state level engineers, and district level officers got together for a capacity-building exercise for six days in Kalpetta, Wayanad. On day one, the basic concept and process of conducting PDNA were introduced, and the participants and the experts went for a field visit to carry out a hands-on exercise on damage assessment.

On the second and third days, the housing team collected data from various levels, including districts, blocks, tehsils, Grama Panchayats, Public Works Department (PWD), and local bodies in Meppadi, Wayanad. The team interacted with the affected people to understand their hardships and gather valuable insights to inform the most suitable recovery strategies.
The Government of Kerala had collected damage data through the local self-government officials. Accordingly, the housing damage assessment by the local body was categorized into three categories, viz., totally damaged buildings (damage more than 70% in existing buildings), severe damage (damage in building systems ranges between 30-70%), and minor damage (damage in building systems less than 30%).

Field Visit

The PDNA team visited the affected area of Meppadi, on August 26, 2024 and consultations were held with the district teams, providing a deep insight into how the top and middle level management viewed the damage and the possible recovery strategies to be adopted for the housing sector.

District level officials provided detailed accounts of the timing and impact of the disasters, which affected a significant number of households. During field visits, it was observed that many areas were prone to landslides to varying degrees, influenced by factors such as soil or rock composition, slope angle, and ground moisture content. The various kinds of damage in buildings observed due to landslides or flash floods are shown in ***Figure 2-6*** to ***Figure 2-8***.

As per Housing damage data provided by state authorities, it was noted that the affected region has in total 2007 housing units spread in ward Nos. 10 (720 buildings),11 (504 buildings), and 12 (783 buildings) respectively. ***Table 2-1*** abridges the ward-wise number of buildings damaged in different classes along with their total plinth area (in sq. m.). The average plinth of houses is obtained as 54.608 sq. m.

Ward No.	Totally Damaged Buildings Plinth Area (nos.)	Severely Damaged Buildings Plinth Area (nos.)	Minor Damaged Buildings Plinth Area (nos.)	Grand Total Plinth Area (nos.)
10	34750.86 (689)	1502.59 (31)		36253.45 (720)
11	23885.97 (485)	1958.9 (18)		25844.87 (503)
12	6826.29 (126)	2913.43 (55)	37760.6 (603)	47500.33 (784)
Grand Total	**65463.12 (1300)**	**6374.92 (104)**	**37760.6 (603)**	**109598.658 (2007)**

Table 2-1: Ward wise number of houses and total plinth area (sq. m.)

Cost of Housing Damage

The estimation of the costs associated with damage, recovery, and reconstruction of houses was undertaken by employing the Plinth Area rates prescribed by the Central Public Works Department (CPWD) and the Kerala Public Works Department (KPWD). The results of this assessment are detailed in ***Table 2-2***.

Housing Loss

The recent disaster has temporarily disrupted the pre-disaster supply chain of goods and services within the housing sector. Assessing the economic impact of the disaster is challenging due to the limited availability of validated data on factors such as rental losses, job losses, and temporary shelter needs.

Quantum and Costing of Damage

The quantity of loss has been calculated under three categories, as fully damaged (more than 70 % damage to the structural system), severely damaged (structural damage ranging between 30-70 %), and minor damage (structural damage less than 30%).

Table 2-1 shows the number of houses under various categories, having an average plinth area of 54.608 sq. m. in Meppadi Grama Panchayat. It is to be noted that the damage cost for fully damaged houses has been considered based on the cost of construction of pucca houses, as per the plinth area rate calculated above [***Table 2-2***], while for severely damaged buildings the damage cost is assumed to be 50% of the plinth area rate (i.e., an average of 30% and 70% of the reconstruction cost). The damage cost of minor damaged buildings has been considered as 20% of reconstruction cost, i.e., 2/3rd of 30%.

Damage cost of INR 227.37 crore is estimated for fully, severely and minor damaged houses. The above estimated damage cost also includes the damage to septic tanks in a similar proportion as adopted for the calculation of the damage cost of buildings.

Also included are the cost of repair of the cattle shed (111 nos.) and loss of protection measures, etc., around the building based on data provided by PWD engineers.

Housing Reconstruction Cost	Cost per sq. m.
Basic cost of construction (A) (INR)	19500
Water supply & Sanitary installation (12.5%A)	2437.5
Internal electrical installation (12.5%A)	2437.5
Site Development (5%A)	975
Add 1% Labour cess	195
Add 1% quality control	195
Add 3% Contingency	585
Total cost of Reconstruction of Pucca House INR/sq. m.	**26325**

Table 2-2: *Details of the plinth area rates approved for assessing the cost of reconstruction of pucca house in the affected region*

Table 2-3: *Details of the damage cost of houses in Meppadi Grama Panchayat*

Sl. No.	Damage Cost	Nos.	Cost/ Housing Unit-Lakh (INR)	Amount - Cr. (INR)
1	**Fully Building damage category 1:** **Average Plinth area** = 51.97 sq. m.: 100% of current value, Including electric wiring, internal water supply and sanitation, Labour cess 1%, GST 18%, Cost of const.: INR.0.26325 /sq. m.	1300	13.68	177.85
2	**Building damage category 2:** **Average Plinth area** = 61.30 sq. m.: 50% of current value, Including electric wiring, internal water supply and sanitation, Labour cess 1%, GST 18%	104	8.07	8.39
3	**Building damage category 3:** **Average Plinth area** = 62.62 sq. m.: 20% of current value, Including electric wiring, internal water supply and sanitation, Labour cess 1%, GST 18%	603	3.30	19.88
4	Septic Tank for fully damaged houses, @70000/-	1300	0.70	9.10
5	Septic Tank for Severely damaged houses, @35000/-	104	0.35	0.36
6	Septic Tank for Severely damaged houses, @14000/-	603	0.14	0.84
7	**Major repair and retrofitting-Cattle Shed**	111	0.75	0.83
8	**Protection measures i.e., retaining wall etc., around the buildings**	1	1,010.00	10.10
	Total Damage			**INR 227.37 Cr.**



Figure 2-9: *Damaged cattle sheds*

2.5. Recovery Needs and Strategy

A total of 2007 pucca houses and 111 cattle sheds have been affected by the disaster. A significant portion of these houses, specifically 1300, are categorized as fully damaged, while 104 are severely damaged and 603 have sustained minor damage. Additionally, 111 cattle sheds require reconstruction. Furthermore, housing provisions must be considered for 42 tribal families as part of the recovery efforts.

It is crucial that the recovery and reconstruction processes align with Build Back Better (BBB) principles to enhance the resilience of the affected communities against both current and future hazards. The Government of Kerala has committed to providing 100 sq. m. houses to each affected household, with the option for vertical or horizontal expansion up to 140 sq. m. at the individual's expense.

Cross Cutting

The costs associated with water and sanitation infrastructure, including septic tanks, within the household plot have been integrated into the housing recovery plan. Water and sanitation services beyond the household plot boundary fall under the purview of the irrigation sector and will be addressed accordingly.

The housing recovery efforts will generate substantial employment opportunities. Establishing small- scale, local resource-based building material production yards will not only support the recovery process but also contribute to Wayanad's goal of achieving green and resilient housing.

Cost of Recovery

The recent disaster, primarily caused by landslides, land subsidence, and debris flow, had significant impact on the region. For cattle sheds, a reconstruction cost of INR 1 lakh per unit was adopted based on discussions with district-level engineers. Similarly, the reconstruction cost of septic tanks for fully damaged units was estimated at INR 70,000, based on data provided by district teams. It's important to note that while the damage costs were calculated based on the average total covered area of pucca houses and cattle sheds, the unit costs for recovery and reconstruction are higher to incorporate Build Back Better (BBB) principles and enhance resilience.

Particulars	Nos.	Cost/ Housing Unit- Lakh (INR)	Amount- Cr. (INR)	Remarks
Land development cost Two sites (Elston Estate and Nedumbala Estate) Total Area = 144 Ha Including the cost of planning, site development works such as grading and administrative costs	2	375 / ha	540	
Reconstruction-pucca house (confined masonry) : Avg. Covered Area= 100 sq. m. Including electric wiring, internal water supply and sanitation, Labour cess 1%, GST 18%	2049	26.325	539.40	2007 Damaged Houses + 42 houses for Tribal families
Reconstruction- Septic Tank, @ Rs 70,000/HU	2049	0.700	14.34	2007 Damaged Houses + 42 houses for Tribal families
Reconstruction of Protection walls around houses	12	100.000	12.00	
Reconstruction of Cattle sheds	111	1.000	1.11	
Total cost of Reconstruction			**INR 1106.85 Cr.**	

Table 2-4 *Reconstruction Cost*

Table 2-5: *Recovery Cost*

Particulars	Nos.	Cost/ Housing Unit- Lakh (INR)	Amount (Crore INR)	Remarks
Ensuring BBB elements in reconstruction, repair and retrofitting, a) training 2 Locations- Food + lodging - 1 training x 70 candidates x INR 75500/ candidate + 35% management cost, toolkit gadgets etc including IEC	2	71.3475	1.43	
Small entrepreneurship 2 units of precast RC posts and DW frames, CSEB, Concrete block, etc,@ INR 50 lakh/ unit excluding leased land	2	50.00	1.00	**Capacity Building**
			2.43 Cr. INR	
Expenditure of the Housing Facilitation Centre				
Run by 7 architects/ engineers @ (INR 75000 salaries + INR 7000 for transport, communications) x 18 months x 2 locations	2	103.320	2.07	
5 Technical assistants @ (INR 50,000 salaries + INR 7000 for transport, communications) x 18 months x2 locations	2	51.30	1.03	
INR 4 Lakh capital cost/ HFC	2	4.00	0.08	**Housing Faciltation Centre**
Communication: Awareness campaign, Workshops, peer review, evaluation, etc and overhead 25%			0.79	
			3.97 Cr. INR	
Total recovery cost (Capacity building + Housing Facilitation Centre)			**INR 6.4 Cr.**	

The existing average total covered area of houses in Wayanad is significantly higher than the national average, which needs to be considered.

To ensure strict adherence to disaster-resilient design principles during the recovery and reconstruction process, a provision for capacity building and the establishment of a facilitation center for 2,000 households has been included. A detailed summary of the reconstruction and recovery needs is provided in ***Table 2-4*** to ***Table 2-5.***

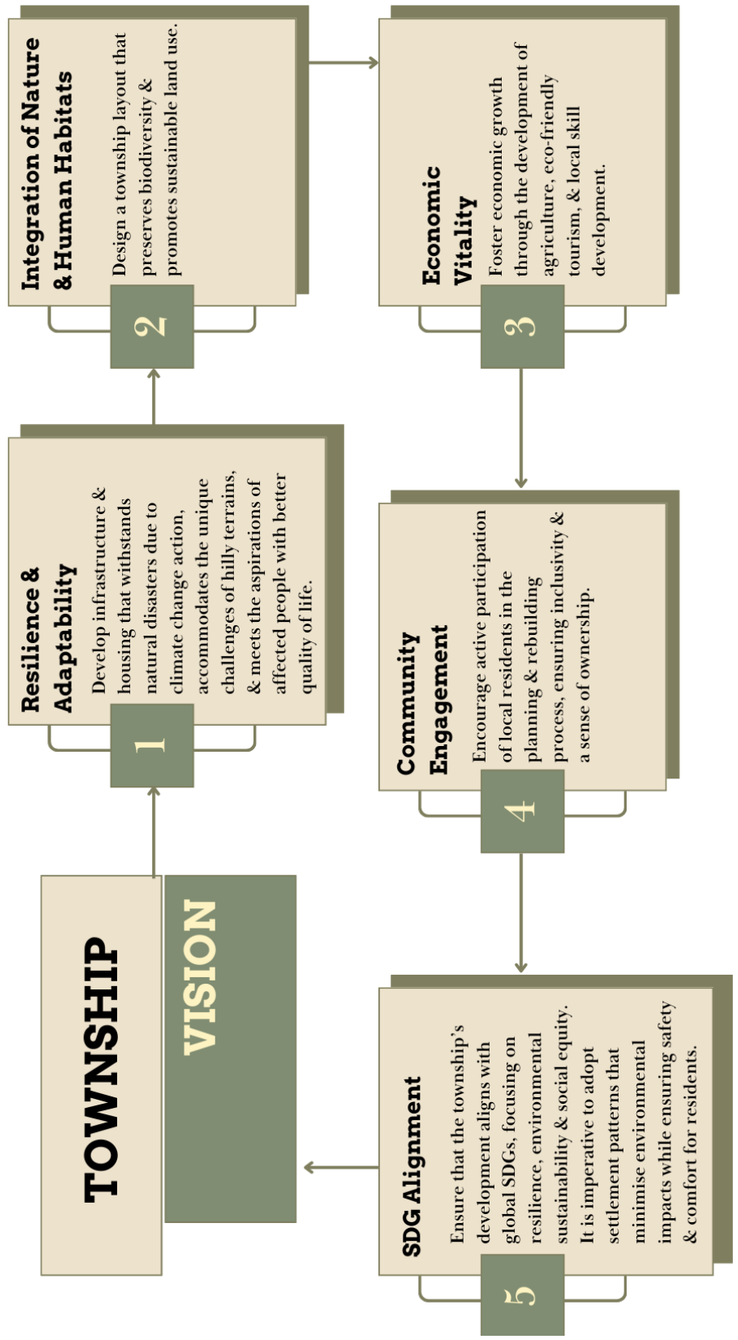


Figure 2-10: The Township Vision for the community

2.6. Relocation Cost of Site and Infrastructure

A total of 2007 houses have been either completely or partially destroyed, necessitating relocation.

During field visits, affected households expressed a preference for relocating to a location near their agricultural fields, ideally along a river. In response, the Kerala Government has announced plans to establish a new township in a safe and secure area to accommodate those displaced or affected by the Meppadi landslide. The proposed township will be developed across two sites, encompassing a total area of 144.06 hectares.

1. Elston Estate, Kalpetta Municipality: The site is located in Kalpetta Village, within the administrative boundaries of Kalpetta municipality and Vythiri Taluk, in Wayanad district, Kerala. The total land area of the site encompasses approximately 78.66 hectares.

2. Nedumbala Estate: The site is located in Kottappadi Village, within the administrative boundaries of Meppadi Grama Panchayat and Vythiri Taluk, in Wayanad district, Kerala. The total land area of the site encompasses approximately 65.4 hectares.

The unit cost of developing the site is estimated to be INR 3.75 Cr. per hectare, including the following costs:

- Settlement planning
- Logistics and transportation
- Site development works, such as grading, contouring, etc.
- Site protection works, such as slope stabilisation, eco-reinforcements, etc.
- Administrative overheads

2.7. Reconstruction

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. The Government of Kerala has announced the township project for rehabilitation of affected people in Meppadi. A reconstruction cost of INR 1106.85 crore for the housing sector has been derived after PDNA.

Homestead style settlements that integrate residential and agricultural uses are particularly suited for the region's agro-based economy. In Wayanad, there are 4 major categories of residents:

- Farmers/cultivators
- Labourers/workers
- Supporting population/servicecommunity
- Tourists/visitors

Demolition and Debris Disposal

Due to the collapse of a large number of buildings/structures, debris management and disposal is of paramount importance and should be initiated as soon as possible. There is a strong need for appointing a dismantling expert for systematic and safe demolition of buildings, debris processing and maximising the salvaging of reusable and recyclable materials.

Care should be taken in handling structurally dangerous buildings, hazardous materials such as asbestos, dust particles, etc. It is estimated that around 195482.175 cum of debris will be collected from the housing site.

Local unskilled people including the house owners can contribute to debris management. While selecting, adapting and developing technologies for reconstruction, efforts can be made to maximise the use of recycled construction materials that will help to reduce debris disposal and other negative environmental impact.

Cost for capacity building of human resources

Based on the site observation and experience gained during the recognition survey of buildings in the affected region, the causes behind those could be attributed to:

- Lack of awareness of the people on landslide safety.

- Masons do not have a very clear idea on how to make a multi-hazard-safe buildings.

- There are hardly any affordable architects or engineers to provide technical and managerial support to the local people in construction.

Table 2-6: *Consolidated table of IS codes*

Sl. No.	IS No.	Title
1	IS 14458 (Part 1) : 1998 Reviewed In : 2022	Retaining wall for hill area - Guidelines: Part 1 selection of type of wall
2	IS 14458 (Part 2) : 1997 Reviewed In : 2022	Retaining wall for hill area - Guidelines: Part 2 design of retaining/breast walls
3	IS 14458 (Part 3) : 1998 Reviewed In : 2022	Retaining wall for hill area - Guidelines: Part 3 Construction of dry-stone walls
4	IS 14458 (Part 4) : 2018 Reviewed In : 2023 Decision taken to Reaffirm and Archive	Retaining wall for hill area - Guidelines: Part 4 Construction of Banded Dry Stone Masonry Walls
5	IS 14458 (Part 5) : 2018 Reviewed In : 2023 Decision taken to Reaffirm and Archive	Retaining wall for hill areas - Guidelines: Part 5 construction of cement stone masonry walls
6	IS 14458 (Part 6) : 2020	Retaining Wall for Hill Area - Guidelines Part 6 Construction of Gabion Walls
7	IS 14458 (Part 7) : 2022	Retaining Wall for Hill Area - Guidelines: Part 7 Construction of Peripheral Reinforced Gabion Walls
8	IS 14496 (Part 1) : 2020	Preparation of Landslide Hazard Zonation Maps in Mountainous Terrains - Guidelines Part 1 Meso-Zonation
9	IS 14496 (Part 2) : 1998 Reviewed In : 2022	Preparation of land slide hazard zonation maps in mountainous terrains - Guidelines: Part 2 macro - Zonation
10	IS 14680: 2024	Landslide Control Measures Guidelines (first revision)
11	IS 14680 : 1999 Reviewed In : 2019	Landslide Control - Guidelines
12	IS 14804 : 2000 Reviewed In : 2022	Siting, design and selection of materials for residential buildings in hilly areas - Guidelines
13	IS 14961: 2024	Surface water management in Hilly Areas (including rainwater harvesting) Guidelines (first revision)
14	IS 14961 : 2001 Reviewed In : 2022	Guidelines for rainwater harvesting in hilly areas by roof water collection system
15	IS 17162: 2020	Preparation of Landslide Risk Assessment Maps in Mountainous Terrains - Guidelines
16	IS 17163: 2020	Site-Specific Investigation and Stability Analysis of Landslides - Guidelines
17	IS 18736: 2024	Micropiles for Slope Stabilization for Mitigation of Landslides - Guidelines

- Lack of awareness of standards in the field of developmental activities of hilly areas such as landslide analysis, site evaluation for human settlement, safe design, selection of building materials, and modes of construction suitable for hilly areas.

Because of this trend for a long time and building construction under the influence of commercial gain, the disaster risk has increased in the urban areas. Considering the ground situation, it is strongly suggested that an immediate intervention is required to enhance the capacity of the local masons so that they do not repeat the past mistakes.

Engineer/Contractors

The locals, architects, and engineers also need capacity building on resilient construction practices considering the multi-hazardous scenario of Wayanad, Kerala.

The need for capacity building of the local contractors is of paramount importance since, in the absence of adequately qualified architects/engineers, the contractors act as the technical advisers to the people.

Entrepreneurship

Very soon, due to the reconstruction program, there would be a sudden rise in the demand for building materials. To deal with the situation, one of the feasible options would be the development of local-level entrepreneurship for producing building materials using local resources and cost-effective, labour-intensive, and environment-friendly methods. Small units run by SHGs (self-help groups) would be a feasible option for Wayanad. It would require small machinery and skill training. There are small-scale manufacturing units for precast materials in the surrounding village of Meppadi. This model can be replicated for the generation of new opportunities.

Housing Facilitation Centres

The disaster-affected people of Meppadi will require technical support at their doorstep to ensure the construction of resilient houses. Housing Facilitation Centers (HFCs) can play a vital role in providing this support. In addition to the proposed township, promoting resilient construction practices is essential as part of disaster mitigation strategies. Each HFC is envisioned to have a minimum staff of three engineers/architects and three technical assistants to assist homeowners, masons, and carpenters. The primary role of these facilitators would be to prepare drawings and estimates for all reconstruction activities, including new construction, repairs, and retrofitting.

To maintain quality standards, a monthly peer review of HFC activities is recommended. This review committee, led by Tehsil-level officials, would involve local engineering college faculty and experienced private architects and engineers with expertise in Build Back Better (BBB) principles.

2.8. Impact of Recovery

Impact of recovery on livelihood and employment

While the landslide has been a disaster, its recovery opens up a window for creating a variety of livelihood opportunities for the local people. The recovery will generate a good number of working days for skilled masons and unskilled workers as well. Alongside, there will be opportunities for skill upgrading through BBB training programs.

Sorting of the stone blocks from the debris will create significant employment, and this will reduce the use of energy intensive materials such as bricks and cement, etc. If labour intensive technologies are adopted in reconstruction based on local materials, there will be a significant increase in employment opportunities and skill building on the exit of the recovery.

Impact of Recycling

Reconstruction of 2049 houses and 111 cattle sheds with the vision of a new township will have an impact on several aspects of the people, environment, and other aspects of the human life in the Wayanad district in the coming 18 months. The following is a brief discussion on the impacts of the recovery interventions on building materials, livelihood, environment, gender, and DRR. The main objective is to make use of the recovery to maximise the environmental and social benefits towards a resilient future Wayanad.

Impact of Reconstruction on Building Materials and Skill

The damage caused by the landslide has resulted in a huge demand for material required to reconstruct in limited time. Unless the reconstruction and repair are well planned, the management of supplying construction materials in the post-disaster scenario would turn out to be a major challenge. If one considers the repair, retrofitting, and reconstruction of houses and cattle sheds, the quantities of materials will be much more.

Since the recovery period is 18 months, there is a need for preparing procurement plans for each Tehsil at the earliest to enable reconstruction work to start. It is very important to look for alternatives, such as stones from the debris.

Impact of Recovery on the Environment

While reconstruction and repair are good opportunities for creating resilient housing alongside creating local level employment, the use of brick, cement, and steel would have a negative impact on the environment. Building materials alone will lead to a significant quantity of emissions of CO2, excluding the emissions caused by transportation.

It is very important that the reconstruction program focuses on the use of green design and appropriate technologies that are climate change resilient and mitigate the negative impact on the environment. Use of local materials, upgraded vernacular construction techniques, alternative materials, and confined masonry would have less negative impact on the environment.

Gender, Social Inclusion and Disaster Risk Reduction

A number of women-headed families were found to be in poor conditions. These HHs should be prioritised in the recovery framework. People with disabilities are also one of the most affected ones due to the disaster. All these groups will need enhanced technical and financial assistance from the government for rebuilding their houses. Safe settlement planning, introducing building bye-laws and building permit systems, and awareness and capacity building of the people and the construction workers will enhance resilience. Formation of women's SHG to support the reconstruction by quality control supervision will be a tool to empower women and give an opportunity to have alternative skills for livelihood.

Role of Line Department

All the government construction departments need to coordinate with each other for the procurement of materials and masons for the reconstruction work. However, they need to strengthen their capacity in DRR by undergoing training. For monitoring and control, an adequate number of staff should be deputed with a clear job description. The HFCs would assist local house owners to develop designs, source materials, and ensure quality control. Local NGOs on a time-bound contract could be appointed to run the HFCs.

2.9. Sector Recovery Strategy

The post-disaster housing recovery in Meppadi deviates from conventional approaches, as in-situ intervention is not a viable option due to the significant risk posed by the affected area.

Consequently, relocation to a safer location is imperative. Past experiences have demonstrated that the lack of public participation in various stages of the relocation process, from site selection to housing design and construction, can hinder the success of such initiatives.

To ensure the successful implementation of the relocation process, it is imperative to involve the affected community in all stages. Given the agricultural and tourism-based livelihoods of the affected population, the new site should be located in close proximity to their original village to minimize disruption to their livelihoods.

The formulation of detailed plans for reconstruction and long-term recovery must be undertaken through a participatory process involving local communities, geologists, ecologists, development experts, engineers, and technologists. These plans should prioritize the needs and aspirations of the affected population, while also ensuring environmental sustainability. The integration of disaster risk reduction strategies into the reconstruction process is essential to build back better and enhance the resilience of the affected communities.

The rehabilitation process should be characterized by a community-driven approach, empowering affected individuals to take ownership of their reconstruction efforts. To ensure the quality and sustainability of the reconstructed homes, robust technical and managerial support is indispensable with BBB principles. Capacity building initiatives for construction workers and a comprehensive assessment of the capabilities of construction material suppliers are crucial components of the recovery process.

A thorough evaluation of the capacities of construction material suppliers is imperative for the effective planning and management of the reconstruction process. Vulnerable groups, such as elderly individuals and people with disabilities, should be prioritized in the initial phase of the recovery process. The rehabilitation project should leverage technology to improve data management and early warning systems, thereby enhancing the long-term sustainability of the recovery efforts.

This approach will ensure the long-term sustainability of the rehabilitation project and empower local governments to effectively manage the recovery process over a three-year period. By promoting the efficient utilization of resources, this approach will contribute to the overall success of the recovery efforts.

Participatory Planning in Context of Wayanad

People's aspiration for their dream home should be at the center of the reconstruction.This would be done by conducting participatory design exercises involving the affected people. People would have the flexibility of customizing the design to suit their pattern of living and culture.

Design and detailing would have the flexibility of expansion to suit individual needs and grow incrementally. Under recovery, a house should be viewed as a complete unit with toilets, drinking water facilities, a solid and liquid waste disposal system, energy, and livestock.

House design and access to the common facilities should be barrier-free for people with disabilities (both temporary and permanent), the elderly, pregnant women, and children. This aspect of house design is very important, especially during emergencies.

2.10. Resilient Wayanad (Building Back Better)

Under the recovery program, the reconstructed houses would act as good examples of resilient houses and inspire, educate, and motivate others in the community. The objective is to bring in a culture of resilience as a part of life and practice, which would make Wayanad resilient for future hazards. The following actions will ensure this objective.

- Adopt Confined Masonry Construction in practice as mandatory for low to medium rise residential building construction, which is multi-hazard resilient, makes use of locally available materials and skills, is cost-effective, and is acceptable by society.
- Implement flood-resilient construction practices for new houses and renovations, considering elevation, foundation, and flood-resistant materials.
- Prioritise the stabilisation of the slope through advanced engineering techniques. Geo-technical studies should be conducted to determine the most suitable stabilisation methods, which might include retaining walls, soil reinforcement, drainage systems, and vegetation control.
- Needs a waste management system to prevent direct disposal of kitchen waste into the land.
- Needs awareness campaigns on flood risks, early warning systems, and emergency preparedness.
- Invest in comprehensive flood management infrastructure, including river embankments, floodwalls, and drainage systems.
- Promote use of non-conventional energy sources in buildings, i.e., solar and wind power, for meeting energy demand in houses.

Rehabilitation Policy for Meppadi

Taking note of the ground realities, together with the aspirations of the people, the state government has decided to provide financial assistance to the affected families in accordance with the decision of the Hon'ble State Cabinet and promote owner driven reconstruction of the affected houses/rehabilitation rather than offering tailor made houses.

The Kerala government has announced plans to establish a new township in a secure area for those displaced by the recent landslide in the Mundakai region. The rehabilitation process aims at enhanced quality of life rather than the provision of basic necessities for sustenance. A model township is proposed to be developed, giving emphasis on "social resilience" and sustainable planning concepts.

Implementation method

The reconstruction process with the technical support of the HFC would be a feasible option in the present context. However, reconstruction of houses for the people with physical or mental disabilities, the elderly, women-headed households, etc., would need government support as well as additional support from HFC. All hands-on mason training programs conducted by the HFC will be at building sites so that additional technical guidance and manpower can be provided to the house owner.

Monitoring and Quality Control

People do need active monitoring and control to avoid the kinds of disasters Wayanad is facing over time. There is a need for high-tech systems for monitoring and control of the reconstruction work since high-quality construction would reduce the frequency of maintenance and enhance the durability of the buildings.

Key recommendations

To support the recovery of the landslide and flood-related disaster in Wayanad and to bring its people back to normalcy by promoting multi-hazard resilience, the following key recommendations have been put forward:

- Prepare a micro-zonation map of the land subsistence and landslide of Wayanad.
- Mandate the adoption of Confined Masonry Construction (CMC) for low-rise residential buildings. This construction technique, which utilizes locally available materials and skills, is cost-effective and offers resilience against multiple hazards, making it a socially acceptable and sustainable choice.
- The decision-making process for the construction of safe structures should be informed by multi-hazard zoning assessments. Site selection and building type should be determined based on these assessments. Strict enforcement of construction regulations in hazard-prone areas is imperative.
- Designate the no-building zones in the land-use maps (e.g., flood-prone areas along riverbanks, unsafe slopes). Anyone building in the no-building zones will not be entitled to receive any government facilities (grants or reliefs)
- Promote use of non-conventional energy sources in buildings, i.e., solar and wind power, for meeting energy demand in houses.
- Implement flood-resilient construction practices for new houses and renovations, considering elevation, foundation, and flood-resistant materials.
- Proper disaster warning system: Establish an early and emergency warning system by monitoring the rainfall and real-time data from various equipment. Develop a system to monitor earth movements like landslides, earthquakes, etc.

Town Planning, Building Rules and Enforcement

- Review the existing town and country planning act and update it from a multi-hazard point of view, that must be in place at the earliest.
- All the local bodies in the district ensure that there is no violation of the existing DDMA Regulation Act 2019.
- Establish an appropriate technolegal regime that stems from the development of the hazard-zonation maps at adequate scales, making building rules applied at house level, and capacity development of regulatory authorities.
- Strengthen enforcement mechanisms in all zones with adequate staffing of competent regulatory agencies and capacity-building of regulatory staff members. However, awareness campaigns appear more useful since compliance with rules is better than imposition.
- Introduce penalties for violations and incentives (non-monetized) for compliance.
- Introduce slope modification regulations to maintain stability of hill slopes, e.g., slope cutting, filling, increasing the amount of ground-water penetrating into slopes, disposing of sewage onto slopes, etc.
- Constitute an expert committee at the state level, district level, and local level to develop guidelines for environmentally sensitive area construction.

2.11. Relocation and Resettlement Planning

- Select safe sites for relocation only after thorough examination of the land by the geologists. As small settlements spread over a large area will reduce negative environmental impact.
- Review the existing land use acts to find out land for relocation.
- In relocation, a group of dwelling units should have an integrated assigned space to allow the residents to carry out some of their small livelihood activities. Similarly, the complex may also include a multi-functional open space for livelihood related activities.
- Creating a comprehensive plan for early recovery needs to ensure that the affected HHs receive the necessary support and assistance during the relocation/rehabilitation process, while also ensuring that the local economy and tourism industry are not severely impacted.
- Develop a township for the affected community and provide all the physical and social infrastructure facilities, i.e., religious structures, playgrounds, libraries, cultural centers, etc.

Temporary Shelter

- Identify geologist-certified safe sites for temporary shelter.
- Provide techno-managerial support to the affected HHs to build temporary shelters and organize construction materials.
- Identify the HHs who are temporarily displaced and currently living with relatives, neighbours, and in rented premises. Provide transportation facilities to the affected HHs to move to the temporary shelters.
- Ensure that the temporary shelters are close to the people's place of livelihood and have adequate mechanisms for education, health, water, and sanitation facilities.

Funding

The state government to finalize the sources of funding.

The housing need (covered area) of the people in Kerala, being much higher than the national average, needs alternative sources of funding; explore the possibility of revolving funding by the communities.

Arrange for funding to establish and run HFCs for 18–24 months.

Immediate Actions

- Identify the sites by the roadside where the buildings are structurally safe but as a whole unsafe because of potential future landslides. Many such buildings could be saved if the retaining walls were constructed at the earliest.
- The local government should release information on severe, high, and medium risk at the earliest and inform about phase wise relocation and evacuation needs. Communication of necessary information will ensure building trust in the communities and ensure community engagement in permanent rehabilitation.

- Relocate people from 'unusable and demolished' buildings. Citizens must be given choices. The relocation must be prioritized based on the following parameters: Elderly/ landless women and single women-headed households, landless citizens, households with land in risky areas. The prioritization should be communicated and consulted with various citizen groups.

2.12. Implementation Plan

The housing recovery process, in consultation with the state government, has been assumed to be 18 months. This requires a "zero-time-wastage" approach in the recovery process. The present recovery process has been divided into two phases *(Page 138-139)*:

a. short-term and b. medium-term

These phases are not independent; instead, they complement one another and have considerable overlap. Reconstruction planning should begin with risk sensitive land use and landscape management based on hazard risk assessment concerned with ecological, social, and economic sustainability at local levels.

Priorities

- Relocation/retrofitting of women-headed houses, persons with disabilities and vulnerable group
- Establish HFCs at the earliest and make them operational.
- Conduct an audit on how many skilled masons and labourers exist in Wayanad and where they are located (migratory and local). Also, carry out skill-gap analysis and implement training (BBB).
- Prepare a procurement plan of the construction materials which are available in the district and assess how much is to be acquired from local sources and neighbouring states. Conduct resource-mapping exercise through the HFC.
- Prepare a detailed construction management plan of the reconstruction work, along with human resources requirements and a mechanism for monitoring and quality control.
- Immediately establish a control room at district offices, networked with HFCs and KSDMA for tight supervision and technical support to the affected people. The control room should be led by a professional Project Manager with computerised planning, scheduling, monitoring and control skills.
- Document the entire process from day one of the housing recovery process.

Short Term 0-12 Months			
S1	Form a project implementation team coordinating with the line deparment.	KSDM	3 months
S2	Establish Housing Facilitation Centres (HFC) to promote speedy, safe and sustainable construction using locally available materials	KSDMA	3 months
S3	Identification of sites of Rehabilitation for families affected by land loss	KSDMA	1 month
S4	Carry out detailed engineering (Holistic planning. design, construction of confined masonry Building) analysis of rehabilitation sites for affected families	KSDMA & TCP	3 mths
S5	Training of masons, unskilled labourers, and engineers for best construction practices, retrofitting, structural health audit of existing and newly constructed buildings/with hands-on exercise with examination and certification	KSDMA	6 months
S6	Mass awareness of building rules, building codes and their compliance	KSDMA	12 months
S7	IEC materials (preferably in pictorial form) on best construction practice, retrofitting, maintenance for awareness of the community, training, drills, and skill development activities in the construction sector	KSDMA	12 months
S8	Reconstruction of the houses and cattle shed	KSDMA & PWD	12 months
S9	Identification of sites for dumping of construction demolition waste at different locations	KSDMA	3 months
S10	Systematic disposal of construction demolition waste to recycle/reuse for value added product	PWD	12 months

S11	Implementation of planned sewerage and drainage system for the community	PWD	6 months
S12	Reconstruction and retrofitting of septic tank	KWA	6 months
S13	Procurement of special equipment for monitoring and control	KSDMA	12 months
S14	Strengthen resources in Kerala: Technical institutions/ knowledge tapping, building materials	KSDMA	12 months
Medium Term 0-18 Months			
M1	Develop micro-zonation (multi-hazard) map in 1:5000 scale for Wayanad, Kerala	KSDMA	12 months
M2	Based on the Mirco zonation map of the landslide, treat the unstabilised slope	KSDMA	12 months
M3	Develop typed design for housing) complete detail including architecture, structural (confined masonry), services etc.	PWD	6 months
M4	Establish Techno legal regime mechanism in Wayanad	KSDMA	18 mths
M5	Reuse, and recycle construction demolition waste into building components	PWD	18 months
M6	Channelise planning processes, stakeholder consultations and IEC campaigns for better outreach.	KSDMA	18 months
M7	Master plan for Kerala with emphasis on controlled land use, slums and unauthorised constructions, constructions in no-development zones, and infrastructure development (roads, water supply etc.)	KSDMA	18 months
M8	The creation of local think tanks with local expertise should be contemplated	KSDMA	18 months



03



Public Building and Civic Amenities

3.1. Basic Profile of the Sector

Chooralmala was a scenic town located at the foothills of Vellarimala. Before the disaster struck, it housed a vibrant and bustling community. Reasonably well-built small shops and commercial establishments were scattered throughout, meeting the everyday needs of residents, and contributing to the local economy. Places of worship, including temples and mosques, were integral to the community, offering a sense of belonging. Additionally, the wards had community spaces like the school playground, which served as a popular venue for recreational activities. Residents frequently used this space to play football, cricket, and engage in various other sports and games. This section of the report provides a detailed overview of the public, community and commercial infrastructure in the region, highlighting the essential roles these elements played in the people's daily lives before the disaster.

For the specific requirement of this report, a detailed examination is conducted in three key areas:

- Commercial Infrastructure
- Community Infrastructure
- Public Infrastructure

Chooralmala features a mix of commercial establishments, including multi-tenant buildings where a single structure may house several shops, each rented by different shop owners, as per the data collected by the Public Works

Figure 3-1: *Key Areas for detailed examination under Public Building and Civil Amenities*



Department (PWD) and LSGD. In addition to these, there are also standalone shops and small vendors. As per the micro-plan survey, 12% of the interviewed families were dependent on small businesses such as driving vehicles, tailoring, barber shops, electricians and small catering and 44 families have lost their bread-winners.The disaster has impacted both types of commercial operations. For certainty in this report, each unit is considered as one individual shop. Primarily, these buildings are built in RCC structure and many had sloping roofs made with tin sheets.

The significant public infrastructure of Chooralmala comprised two post offices, a village office, a library, two financial institutions (Kerala Bank and Kerala Gramin Bank), and an Akshaya center. Community-owned spaces and buildings encompass various facilities, including six religious structures (one church, two temples, and three mosques) as well as community halls and playgrounds. The religious buildings varied in size, ranging from 25 to 160 sq. m. In terms of open spaces, two playgrounds were identified: the Vellarmala School (GVHSS) playground at Chooralmala and an estate playground at Mundakkai.

3.2. Sectoral Policies

No single department fully oversees commercial, public, and community infrastructure amenities. However, there are few schemes provided by the State and Central Government that may be leveraged for the recovery interventions in the region and efforts of rehabilitation of these community spaces may be channelised through these schemes. Some of the relevant schemes that may be leveraged are:

State Government aided schemes:
Local governments are provided with several funds by the State Government for the development of various amenities. The total amount allocated in the 2024 - 25 financial year under the Development Fund (General) and CFC grant is about INR 4.67 Cr for Meppadi Grama Panchayat. In response to the disaster, for relief and reconstruction activities, certain regulations regarding mandatory sector-wise allocation for the annual plan have already been relaxed for Meppadi Grama Panchayat. Along with this, a reconstruction plan for the commercial infrastructure could be envisioned with the help of Block and District Panchayat funds.



Figure 3-2: Landslide affected commercial establishments

Table 3-1: *Pre-Disaster Profile*

Sl. No.	Category	Type	Number
1	Commercial	Tailoring Shops	3
2	Commercial	Bakery	6
3	Commercial	Hotel	3
4	Commercial	Beauty Parlour / Barber Shops	4
5	Commercial	Supermarkets	4
6	Commercial	Medical shops and labs	2
7	Commercial	Fish and Meat stalls	5
8	Commercial	Hardware and Furniture	13
9	Commercial	Other Shops	66
10	Community	Halls	1
11	Community	Religious Buildings	6
12	Community	Playground	2
13	Public	Public Offices	3
14	Public	Post Office	2

[Source: Based on data collected by Kerala Vyapari Vyavasai Ekopana Samithi, LSG DM Plan and Primary Study]

National Rural Livelihoods mission (NRLM):
Aims to improve the lives of rural poor households. Self-help groups can get assistance through this program through marketing support. Business development can also be achieved through this program.

Kerala Infrastructure Investment Fund Board (KIIFB):
KIIFB-funded projects can be planned for the development of educational and health infrastructures. At present sectors aided by KIIFB funding include education, health, power, transport etc. But here it is being suggested to extend this to commercial infrastructure development also as it will aid in the better reconstruction of this sector.

Rural Infrastructure Development Fund (RIDF):
The annual allocation of RIDF Tranche XXIX (2023-24) was about INR 40475 Cr. About 21% of the cumulative share has been sanctioned for the social sector. Many of the individual storage facilities have been completely washed away in the disaster. Using RIDF assistance, schemes can be developed for the market yards, godowns/warehouses, other marketing infrastructure etc. thereby helping in the overall recovery of this sector.

PM Formalisation of Micro Food Processing Enterprises Scheme:
Through this scheme, assistance can be provided to SHGs for setting up or upgrading micro food processing enterprises. Projects under this scheme may be eligible for loans up to 90% of their actual cost.

3.3. Damages in the Sector

The initial assessment of building damage was conducted through a rapid visual screening from August 9th to August 13th, 2024. This process was carried out by teams from LSGD

Engineering, the Department of Mining and Geology, the Department of Health, the Revenue Department, and representatives from the Local Self Government (LSG). Detailed valuation and loss estimation were subsequently conducted by the Public Works Department. Additionally, a household-level needs assessment survey was conducted by the Kudumbashree Mission. The final assessment of damage, loss, and reconstruction needs was derived from these efforts to establish a comprehensive framework for rehabilitation and recovery.

The evaluation of damage, loss, and reconstruction requirements was based on data collected by the Public Works Department after the disaster, a household survey conducted by the district administration, field surveys by the assessment team, and interviews with local representatives of the LSGD and affected communities.

The data gathered by the Public Works Department focused on damage to physical infrastructure, which was used to calculate damage estimates, while survey information helped determine the losses and recovery needs of the affected population.

Damage Estimate

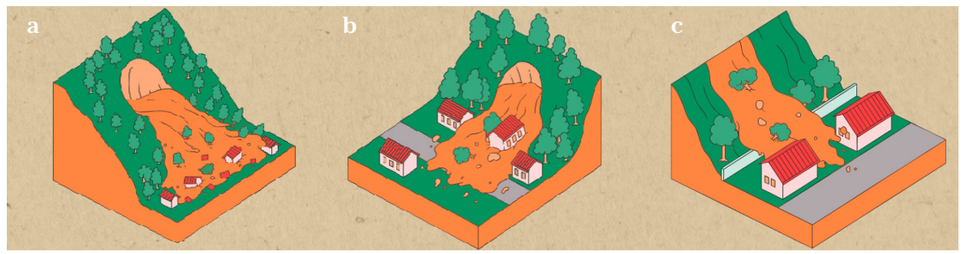
A total of 107 affected units were assessed and were classified under three categories:

a. Fully Damaged or Washed Away
b. Partially Damaged or Washed Away and
c. No Damage.

It must be understood that the impacted areas were completely washed away in the aftermath of the disaster, due to the lack of the latest baseline information on the sector, the chances of inaccuracy in the numbers reported may be high.

- Out of 99 commercial units including small shops such as bakeries, restaurants, fancy shops, stationery shops, small banks, ATMs etc. that were assessed 64 units were totally washed away, 18 were partially damaged and 17 units reported no damage.
- Community buildings in Chooralmala including churches, mosques and temples sustained complete and partial damage.
- Damage to public buildings includes damage to a village office building and one post office.

Figure 3-3: *Public Building and Civil Amenities Damage Estimates*



64 units totally washed away *18 units partially damaged* *17 units reported no damage*



One Village Office & one Post Office were damaged; The former was completely washed away



One religious building got washed away in Ward 1 and another got damaged in Ward 12

Figure 3-4: *Fully damaged shops*



Figure 3-5: *Severely impacted shops*

Figure 3-6: *Site of the Temple in ruins*





Figure 3-7: *Partially damaged Mosque*

Table 3-2: Damage Estimates (in numbers)

Category	Ward No.	Fully Damaged	Partially Damaged	No Damage	Grand Total
Commercial Units	10	27	4	5	36
	11	33	nil	12	45
	12	4	14	nil	18
Commercial Units Total	**-**	**64**	**18**	**17**	**99**
Community Buildings	10	nil	nil	2	2
	11	1	nil	nil	1
	12	1	nil	2	3
Community Buildings Total	**-**	**2**	**-**	**4**	**6**
Public Buildings	10	2	nil	nil	2
Public Buildings Total	**-**	**2**	**-**	**-**	**2**
Grand Total	**-**	**68**	**18**	**21**	**107**

[Source: Based on RVS]

Category	Ward No.	Fully Damaged	Partially Damaged	No Damage	Grand Total
Commercial Units	10	738.38	107.2	75	920.58
	11	1026.09	nil	695.41	1721.5
	12	67.64	339.42	nil	407.06
Commercial Units Total	**-**	**1832.11**	**446.62**	**770.41**	**3049.14**
Community Buildings	10	nil	nil	89	89
	11	98	nil	nil	98
	12	25	nil	260	285
Community Buildings Total	**-**	**123**	**-**	**349**	**472**
Public Buildings	10	65.4	nil	nil	65.4
Public Buildings Total	**-**	**65.4**	**-**	**-**	**65.4**
Grand Total	**-**	**2020.51**	**446.62**	**1119.41**	**3586.54**

Table 3-3: Damage Plinth Area (sq. m.)

Damage Cost

The Public Works Department has collected data and categorised buildings based on their type of construction and plinth area. For Category A buildings, the reconstruction cost per square metre of plinth area is INR 25,500, while for Category B buildings, it is INR 21,000 per square metre. These rates are based on the 2019 Plinth Area Rate. According to a government order from the Public Works Department, a cost index of 1.36 or (36%) for Kalpetta is applied when calculating the damage estimates.

As per data, the fully damaged plinth area is 2020.51 sq. m, the partially damaged area is 446.62 sq. m. and 1119.41 sq. m. of plinth area has been reported as no damage.

The total damage estimate includes an additional 4% for the provision of water supply and 12.5% for electricity. For partially damaged buildings, a damage factor of 0.5 is applied to estimate the approximate damage costs. The overall damage estimate for commercial units, community buildings, and public buildings is estimated to be INR 8.10 Cr.

3.4. Loss Estimate

To assess the losses, consultations with community members were conducted to understand the nature and extent of the damages. This included evaluating losses related to building rentals for shop owners and inventory losses. During various focus group discussions with community members, a key finding was the prevalence of small commercial loans taken by people, mainly from Kerala Gramin Bank, Kerala Bank, and other banks. For loss estimation, data collected by the Kerala Vyapari Vyavasayi Ekopana Samithi, as provided by the Ward Member, was considered. This has been detailed in the section on Micro, Small and Medium Enterprises.

The total estimated loss for commercial units, public buildings, and community buildings is INR 8.1 Cr (excluding income and inventory losses of commercial units).

Category	Ward No.	Fully Damaged	Partially Damaged	No Damage	Grand Total
Commercial Units	10	2.57	0.21	0.00	2.79
	11	3.68	nil	0.00	3.68
	12	0.26	0.68	nil	0.93
Commercial Units Total	**-**	**6.51**	**0.89**	**0.00**	**7.40**
Community Buildings	10	nil	nil	0.00	0.00
	11	0.39	nil	nil	0.39
	12	0.08	nil	0.00	0.08
Community Buildings Total	**-**	**0.48**	**-**	**0.00**	**0.48**
Public Buildings	10	0.22	nil	nil	0.22
Public Buildings Total	**-**	**0.22**	**-**	**-**	**0.22**
Grand Total	**-**	**7.21**	**0.89**	**0.00**	**8.10**

Table 3-4: Total Damage Estimate (in Crore)

Socio-Economic Impact on People

- The landslide directly impacted over 75 small-scale businesses whose combined average monthly income is estimated to be over INR 25 lakhs. These included stationery stores, restaurants, grocery shops, and barber shops among others.
- These small-scale business owners are also burdened by debt amounting to approx. 3.6 crores. It was also observed that the recovery of the businesses would be severely impacted due to the lack of alternative income sources and minimal savings.
- The landslide also washed away two playgrounds, including the Vellarmala school playground which hosted many sporting and cultural events throughout the year, thereby impacting the socio-cultural nerve centre of the affected area.
- Two religious buildings - one temple and one mosque were impacted. The temple was completely destroyed and a section of the mosque was severely damaged by a large boulder.
- Since the Vellarmala GVHSS was severely impacted, the school records of over 600 students were lost. Official documents such as Aadhaar cards, ration cards, passports and degree certificates were lost as reported by nearly 4000 people in relief camps. Additionally, since the Vellarimala village office was inundated, the land records stored inside were lost.
- Mundakkai post office was fully damaged, disrupting not just postal services but also impacting other services such as banking, insurance and bill payments.
- One community library was also destroyed in the landslide affecting community services.
- The discussion revealed that most people in the community heavily relied on physical assets, such as shops, and had limited knowledge of financial assets like mutual funds, stocks, and fixed deposits. With the loss of these physical assets, the community members now lack savings and liquid income.

Response by the Government

The local, district administration and state governments have prioritised relief and rehabilitation measures on a priority basis to help the surviving people in the affected area. Within one month of the disaster, people were rehoused in rental units from camp facilities. Additionally, the following measures were undertaken by the government to assist the affected individuals:

- The NDRF and Aapda Mitra volunteers were mobilised to help clear debris and clean the affected areas.
- A sum of INR 300 per family per day is disbursed to households rehabilitated in rental units.
- The local body collected the details of traders affected by the landslide from the Kerala Vyapari Vyavasai Ekopana Samithi including information on the losses incurred and the pending bank loans.
- The revenue department has collected the details of people who have lost their official documents such as title deeds etc.
- The Vellarmala post office resumed operations at limited capacity within 3 weeks after the disaster to serve the surviving population.

3.5. Reconstruction and Recovery Needs Assessment

The reconstruction and recovery program offers an opportunity to create local employment generation and revive the culture of the community. Given the impact of the landslide, many small commercial enterprises, and public services are facing significant hardships. The aim of the recovery and reconstruction efforts for public and community building, primarily, is to support the re-establishment of immediate public services and local livelihoods to revive economic activity across the affected community as soon as possible.

The proposed recovery and reconstruction needs for these services expand its limitation beyond resilient infrastructure and look at resilience from a holistic perspective. The recovery program aims to make citizens and services structurally, economically and socially resilient. The recovery will be focussed on in-situ rehabilitation of a few structures and developing a new township where the buildings are culturally sensitive, services are resilient and there is more awareness of risk among citizens.

In-site reconstruction and early recovery needs

The government of Kerala is in consensus that all the affected people along with the people in the no-go zone will be relocated to a different location. With that perspective, a large area of land with debris will be abandoned. Chooralmala, being located on the route to various tourist places, acted as a small market place for tourists and therefore, some buildings that are not damaged may be considered for repair and cleaning as an early recovery intervention. The total in-situ recovery cost amounts to INR 1.561 Cr.

A few proposed early recovery interventions for the existing Chooralmala town and market area are as follows:

- Clearance of debris and rubble in Chooralmala market areas must be done on an urgent basis; this is essential to revive the local economy and liveability of the place.
- Clearance of the road near the bridge and barricading access into the Chooralmala town.
- Develop and train a team of social workers to undertake a detailed needs assessment of people to quantify the requirements.
- Conduct a detailed survey of all the public services and small commercial activities to understand the needs of post office, village office, PDS systems.
- In-situ reconstruction of the Mundakkai village office building will be essential to provide services to people who are still residing in the region. This will be crucial for restoring public services, which are necessary to support relocation efforts.
- Repair and refurbishment of 17 shops in Chooralmala town which have been reported as not damaged. It is understood that few shop owners do not live in the village and have been operating shops in Chooralmala town. These 17 shops must be provided with funds of INR 20,000 to restart their economic activities.
- Repair and reconstruction of Mundakkai mosque may be considered in order to provide space for prayers for the citizens who may want to stay in the village since there are approximately 603 houses in the affected area which are not damaged or have sustained minor damages.
- Establish a document facilitation centre for retrieving old documents, and issuing fresh documents including land records, passports, insurance documents, bank accounts, ATM cards, phone numbers etc.
- Provide loan waivers to all small commercial enterprises of up to INR 5 lakh per enterprise; a detailed survey must be done of all affected populations to understand their outstanding debts and liabilities.
- Provision of soft loans of up to INR 10 lakh to enterprises, women-headed households, physically disabled people and people who want to initiate their own business.

3.6. Resilient Township and Long-Term Recovery Measures

The Government of Kerala has a vision of relocating the affected population to a safe and resilient township which aims to create a thriving and vibrant social life. A few objectives of the proposed new township that align with the needs concerning public, community and commercial infrastructure include economic revitalisation, ensuring rehabilitation of the socio-cultural fabric, self-sufficiency, and community participation in the recovery process.

In alignment with the vision, a green field development has been proposed to relocate 728 households currently living in rented accommodation with a long-term plan of relocating 2000 households. There is a need to propose the reconstruction of new facilities and civic amenities in the proposed township that align







Figure 3-8: *Public Office Complex (Conceptual Representation)*
**[Source: Image generated with AI]*

with the cultural practices. Secondly, 42 tribal families in the vulnerable areas need to be relocated to a safe area closer to the forest areas; which requires the provision of various public services and community needs.

As part of the reconstruction efforts, the built infrastructure must include small clusters of shops and recreational spaces. The proposal includes the development of (a) Public Office Complex (b) Community Spaces and Civic Amenities and (c) Commercial Areas.

After the PDNA a detailed project report must be developed for the proposed infrastructure and may have the following overarching principles:

- **Universal and Inclusive design:**
  All spaces are to be inclusive and accessible for the elderly population, children and people with disabilities.

- **Vernacular Design:**
  The design of these spaces must follow the vernacular design, incorporating traditional building typologies and architectural design.

- **Green and Sustainable Design:**
  The buildings may consider adopting green and sustainable design principles, adopt solar passive design to reduce the operational cost and emerge as a green township.

- **Integrate Disaster Risk Reduction measures:**
  All buildings need to incorporate features to mitigate disaster risk and there needs to be provision of open spaces for evacuation. Everyone, who is providing services in public, community or commercial spaces must be provided training on emergency response as well.

- **Public Offices Complex:**
  A public service complex of 1000 sq. m. area is proposed along with open spaces. This public office complex may have but is not limited to the following spaces:

(a) **Village Office:**
A full-fledged village office of 120 sq. m is proposed, which will act as an administrative centre for the new township. This office will include furniture, computers, and necessary equipment. It is also proposed to install an Automatic Weather station in the village panchayat to collect and disseminate daily weather data to the people

(b) **Customer Service Centre:**
Two Customer Service Centres (Akshaya Centres) of a minimum of 30 sq.m. are to be provided to facilitate digital services like bill payments, form submission and e-governance.

(c) **Agriculture Extension Services:**
Provision of one Agriculture Extension Service to provide information to farmers on best practices of agriculture.

(d) **Banking Facilities:**
Provision of 1 large bank of a minimum of 200 sq. m which may be rented out to a commercial bank.

(e) **Post Office:**
Provision of 1 small post office to be integrated within the public office complex

(f) **Police Outpost:**
Provision of 1 small police outpost.

(g) **Public Distribution Centre:**
The provision of a public distribution centre with a storage facility for grains is essential to reinstate the Public Distribution Services for continuity of services.

(h) **Recovery Facilitation Centre:**
Recovery and rehabilitation of affected people is a time-consuming process which will also require a small facilitation centre that will help the affected communities to access social protection schemes.

(i) **Meeting Halls:**
The public office complex would have meeting halls of various sizes and an open space to organise indoor and outdoor public meetings, training and workshops.

Community Buildings and Civic Amenities:

Investing in community infrastructure is vital for creating a vibrant social life for the community. The following facilities may be considered while designing the new township:



Community Halls:
Two community halls with an area of 600 sq. m. each are proposed for the new township. These must be located close to neighbourhoods for easy access.



Neighbourhood Parks/Children Play Area:
The township is conceptualised to be made of walkable, green and clean neighbourhoods that would require well-maintained open spaces. Two neighbourhood parks of 500 sq. m. each have been proposed within neighbourhoods to support community interaction and provide ecosystem services.



Playgrounds:
One large playground of 1 ha is proposed in the new township to host socio-cultural and sporting events.



Cremation and Burial grounds:
One cremation ground of 500 sq. m. and one burial ground of 500 sq. m. is proposed.



Old age home and Palliative Care - Pakalveedu:
32 elderly-only households were displaced by the landslide. Additionally, Kerala's demographic trends show the emergence of an ageing population which demands the need for an old age home, with a palliative care unit, is imperative in the new township. Hence, a facility of 1000 sq. m. is proposed.



Religious Buildings:
Places of worship would be required in the new township whose population is projected to be 45% Hindu, 45% Muslim and 10% Christian, as per the data obtained from the household survey. Therefore, five religious buildings comprising two temples, two mosques and one church are proposed in the new township occupying a total of 250 sq. m. built-up area.



Library:
Reading rooms and library facilities are essential in promoting literacy and reading habits among people. Hence, the new township must include one library with an area of 300 sq. m.



Skilling Training Centre:
Re-skilling and up-skilling the affected population is essential for reviving their livelihood and aiding their recovery. Existing skill training centres can be identified to support the various programmes for the affected community. Additionally, one training centre can be provided in the township with an area of 120 sq. m.



Bus Stops:
Since the township is spread over an area of 150 ha, three bus stops have been proposed to enhance the connectivity of the town with the neighbouring centres.



Mini Fire Station:
To strengthen emergency response, a mini fire station is proposed with an area of 200 sq. m.

Community infrastructure for the tribal communities:

42 households of the tribal communities were affected by the landslide. Since they are a close-knit community, usually cut off from service centres, it is essential to have community infrastructure close to their places of habitation.

In this regard, the following infrastructure may be considered:

- Community centre: Tribal communities have many shared rituals and congregational activities. Hence, a community centre with an area of 100 sq. m. is proposed near the areas of tribal settlement
- Skill training centre and storage unit (Van Vikas Dhan Kendra): A skill training centre of 120 sq. m. may be provided to support training activities of the tribal communities with an additional storage unit to store forest produce for value addition and trade.
- Samoohya Padana Kendram: A community study hall of 50 sq. m. is proposed for the tribal communities to support learning initiatives.
- Religious buildings: Since tribal communities are deeply rooted in tradition, 4 religious buildings/structures (one for each community) are proposed to house their kula deivam (tribal gods) spanning an area of 20 sq. m.

Commercial Infrastructure:

It is essential to provide infrastructure to support commercial activities which would help build the economy and facilitate the recovery of the affected population. The following may be considered while developing commercial infrastructure:

- Market clusters: Three market clusters, each having a 5000 sq. m. land area are proposed to develop marketplaces and commercial centres. These can house shopping centres as well as open markets.
- Construction of shops and procuring equipment: Within the larger market clusters 150 shops with a total area of 6500 sq. m. have been proposed. The following three typologies may be considered:

  – 75 small shops with an area of 20 sq. m. each
  – 50 medium shops of 40 sq. m. each
  – 25 large shops of 80 sq. m. each

- Vendors and vending units: 50 Vending units including small kiosks and pushcarts each having an area of 8 sq. m. may be considered.

Programs aimed at disaster general for all sections not under common infra alone must be undertaken to strengthen community based disaster risk reduction for INR 0.341 Cr.

3.7. Reconstruction and Recovery Cost Estimates

Reconstruction cost estimate is based on the physical infrastructure components while recovery cost estimate focuses on the socio-cultural component of the community. Details of recovery and reconstruction cost estimates are listed in table

- Reconstruction cost estimates provide insights for future infrastructure development and are categorised into three subsections - In-Situ Reconstruction Cost Estimate, Township Reconstruction Cost Estimate and Tribal Population Reconstruc- tion Cost Estimate. The total reconstruction cost estimate amounts to INR 43.071 Cr. as detailed in the table below.
- The recovery cost estimate considers the investment required for building social capacities and supporting overall development. The total recovery cost including disaster risk reduction measures accounts for INR 17.941 Cr.

Table 3-5 Reconstruction Cost Estimates (In Crores)

In-Site Reconstruction Cost Estimate							
Sl. No.	Category	Reconstruction and Recovery Measures	Nos.	Size	Unit Cost for Reconstruction	Cost Estimate	Total Cost (in crores)	Timelines
1	Public Buildings	In-situ reconstruction of village office building of 65 Sq. m	1	65	32875.5	2136907.5	0.214	3-6 months
2	Community Buildings and Civic Amenities	Rehabilitation of a playground of 1 Ha including levelling of the damaged area	1	10000	1000	10000000	1.000	3-6 months
3	Community Buildings and Civic Amenities	Rehabilitation of severely damaged mosque in Mundakkai	1	90	29295	2636550	0.264	3-6 months
4	Commercial	Cleaning and rehabilitation of no damage-commercial @20,000 INR per shop	1	17	20000	340000	0.034	3-6 months
		Sub-Total					**1.511**	
Township- Reconstruction Cost Estimate								
Sl. No.	Category	Reconstruction and Recovery Measures	Nos.	Size	Unit Cost for structures	Cost Estimate	Total Cost (in crores)	Timelines
1	Public Buildings	Construction of a Public Office Complex of 1000 sq. m. in the proposed township to house various public offices, meeting halls and provision of public services. Including water, sanitation, electric conduits etc	1	1000	38005.5	38005500	3.801	12-72 months
2	Community Buildings and Civic Amenities	Construction of two community halls @600 sq. m; along with open spaces	2	600	38005.5	45606600	4.561	12-72 months

3	Community Buildings and Civic Amenities	Provision of two Neighbourhood Parks @500 sq. m. each	2	500	1000	1000000	0.100	12-72 months
4	Community Buildings and Civic Amenities	Provision of 1 large playground of 1 Ha to organise outdoor activities/sports etc.	1	10000	1000	10000000	1.000	12-72 months
5	Community Buildings and Civic Amenities	Allocation of area for designated burial ground of 500 sq. m.	1	500	1000	500000	0.050	12-72 months
6	Community Buildings and Civic Amenities	Construction of Cremation Ground of 500 sq. m.	1	500	1000	500000	0.050	12-72 months
7	Community Buildings and Civic Amenities	Construction of Palliative care, Old Age Home and Pakalveedu for 50 inmates and 200 floating population	1	1000	38005.5	38005500	3.801	12-72 months
8	Community Buildings and Civic Amenities	Construction of 5 religious buildings of 50 sq. m. each	5	50	38005.5	9501375	0.950	12-72 months
9	Community Buildings and Civic Amenities	Provision and development of 0.5 Acres of land for the construction of mini fire station	1	2000	1000	2000000	0.200	12-72 months
10	Community Buildings and Civic Amenities	Construction of a Mini Fire Station of 200 sq. m.	1	200	38005.5	7601100	0.760	12-72 months
11	Community Buildings and Civic Amenities	Construction of a community library and Reading Room of 150 sq. m.	1	150	38005.5	5700825	0.570	12-72 months

12	Community Buildings and Civic Amenities	Construction of skill building centre of 150 sq. m.	1	150	38005.5	5700825	0.570	12-72 months
13	Community Buildings and Civic Amenities	Construction of three bus stops	3	15	21000	945000	0.095	12-72 months
14	Community Buildings and Civic Amenities	Provision of street lighting for 15 km internal road - including poles, lights and excluding, wires, transformers and sub-stations	1	450	20000	9000000	0.900	12-72 months
15	Community Buildings and Civic Amenities	Provision of street lightning for 5 km approach road including poles, lights and excluding, wires, transformers and sub-stations	1	150	20000	3000000	0.300	12-72 months
16	Commercial	Provision of 3 clusters of 5000 sq. m land for small market area and land development costs	3	5000	1000	15000000	1.500	12-72 months
17	Commercial	Construction of small shops of 20 sq. m. each	75	20	38005.5	57008250	5.701	12-72 months
18	Commercial	Construction of medium shops of 40 sq. m. each	50	40	38005.5	76011000	7.601	12-72 months
19	Commercial	Construction of large shops of 80 sq. m. each	25	80	38005.5	76011000	7.601	12-72 months
20	Commercial	Provision of small vendors and vending units	50	8	3000	1200000	0.120	12-72 months
		Sub-Total					**40.230**	

Tribal Population - Reconstruction Cost Estimate								
Sl. No	**Category**	**Reconstruction Measures**	**Nos.**	**Size**	**Unit Cost for structures**	**Cost Estimate**	**Total Cost (in crores)**	**Timelines**
1	Community	Construction of Community Centre	1	100	38005.5	3800550	0.380	6-12 months
2	Community	Construction of Skill training centre and storage unit (Van Dhan Vikas Kendra	1	120	38005.5	4560660	0.456	6-12 months
3	Community	Construction of Samoohya Padhana Kendram	1	50	38005.5	1900275	0.190	12-72 months
4	Community	Construction of Religious buildings	4	20	38005.5	3040440	0.304	12-72 months
		Sub-Total					**1.330**	
		Total Reconstruction Needs Estimate					**43.071**	

Table 3-6: Recovery Cost Estimates (in Crores)

Training and Capacity Building								
Sl. No.	**Category**	**Recovery Measures**	**Nos.**	**Size**	**Unit Cost**	**Cost Estimate**	**Total Cost (in crores)**	**Timelines**
1	Community and Civic Amenities	Organise sports and cultural meets to demonstrate the spirit of resilience	3	1	500000	1500000	0.150	6-12 months
2	Commercial	Training and capacity building of shop owners on insurance and risk transfer and developing financial literacy (5 Training sessions)	75	5	200000	1000000	0.100	6-12 months
3	Commercial	Skill building for women of women-headed households (10 training sessions)	50	10	200000	2000000	0.200	6-12 months
		Sub-Total					**0.450**	
Financial Assistance								
Sl. No.	**Category**	**Recovery Measures**	**Nos**	**Size**	**Unit Cost**	**Cost Estimate**	**Total Cost (in crores)**	**Timelines**
1	Commercial	Loan waiver of people taking commercial loans/ gold loans (Up to 5 Lakh per commercial unit)	75	1	500000	37500000	3.750	3-6 months
2	Commercial	Provision of soft loans to small commercial shop owners to restart small businesses (10 Lakh per person)	75	1	1000000	75000000	7.500	3-6 months

3	Commercial	Provision of soft loans to small widowed and women entrepreneurs to restart small businesses (10 lakh per woman)	50	1	1000000	50000000	5.000	3-6 months
		Sub-Total					**16.250**	

Disaster Risk Reduction								
Sl. No.	**Category**	**Recovery Measurestv**	**Nos.**	**Size**	**Unit Cost for Reconstruction**	**Cost Estimate**	**Total Cost (in crores)**	**Timelines**
1	Public Buildings	Develop local-level department disaster management plan for integration of DRR in development planning for 3 years	1	3	500000	1500000	0.150	6-72 months
2	Public Buildings	Installation of disaster alert systems, and hooters on community buildings.	1	1	1000000	1000000	0.100	6-72 months
3	Public Buildings	Setting up village disaster management task force and provision of disaster management kits to be placed in the public office complex	1	1	100000	100000	0.010	6-72 months
4	Community and Civic Amenities	Training and capacity building of shop owners on early warning systems, preparedness measures and disaster response.	1	3	200000	600000	0.060	6-72 months
5	Community and Civic Amenities	Strengthening community youth groups, and nature clubs to sensitize people on climate change.	1	3	50000	150000	0.015	6-72 months
6	Community and Civic Amenities	Develop a citizen-led biodiversity register to naturalise people to new locations.	1	3	10000	30000	0.003	6-72 months

Disaster Risk Reduction								
Sl. No.	**Category**	**Recovery Measurestv**	**Nos.**	**Size**	**Unit Cost for Reconstruction**	**Cost Estimate**	**Total Cost (in crores)**	**Timelines**
7	Community and Civic Amenities	Develop community-led risk mapping exercises for relocated populations.	1	3	10000	30000	0.003	6-72 months
		Sub-Total					**0.341**	
		Total Recovery Needs Estimate					**17.941**	
		Grand Total of Reconstruction and Recovery Cost Estimate					**61.012**	

3.8. Impact of Recovery

Recovery measures are classified into 3 categories - training and capacity-building, financial assistance and service continuity.

Under capacity-building measures programs aimed at knowledge-building in insurance, risk transfer and financial literacy are suggested for shop owners. Skill training programs are to be designed specifically for women-headed households to equip them with vocational skills such as tailoring, handicrafts etc. to facilitate income generation. Organising sports and cultural meets may also be undertaken to sensitise the people on the spirit of resilience.

Financial recovery measures have a significant impact on people and therefore it has been suggested to waive the loans of small businesses to fast track the transition. Additionally, provisions for soft loans to small commercial shop owners and women entrepreneurs to start small-scale businesses are proposed.

Considering service continuity, a facilitation centre to issue fresh documents is proposed to help the affected people recover the lost documents such as Aadhaar cards, school certificates, title deeds etc. A proposal for developing an efficient supply chain management system involving local vendors and markets is suggested to boost the local economy and optimise resource utilisation.

Phasing of recovery measures has also been done to address early, medium and long-term interventions. Early recovery interventions would support the affected population by providing interim relief and immediate restoration of services. Medium and long-term interventions would be aimed at the Build Back Better ideology while supporting community-based disaster risk reduction and resilience development measures. DRR measures for strengthening resilience in community groups have been detailed in the subsequent section on Disaster Risk Reduction.

The Town Planning Department will undertake the overall planning of the township, incorporating the measures for disaster risk reduction, thereby playing a vital role in the implementation of the project.

Public and commercial infrastructure works planned for the township can be headed by the Local Self Government Department. Other departments must act as supporting agencies and implementation partners for various needs such as PWD for infrastructure and State Government establishments such as KWA and KSEB for water and electricity services, LSGD Engineering Wing for infrastructure works related to Local Government assets, KILA for KIIFB-assisted works etc.

A township can be planned and built incorporating all these line departments so that the project will be completed and rehabilitation and recovery can be done in time. The assistance of all the other government departments will be required for the establishment of various services that are to be provided in connection with the rehabilitation. Measures may be taken to increase the availability of construction materials from local sources and materials displaced by the landslide to reduce the overall construction cost and promote carbon-neutral efforts.

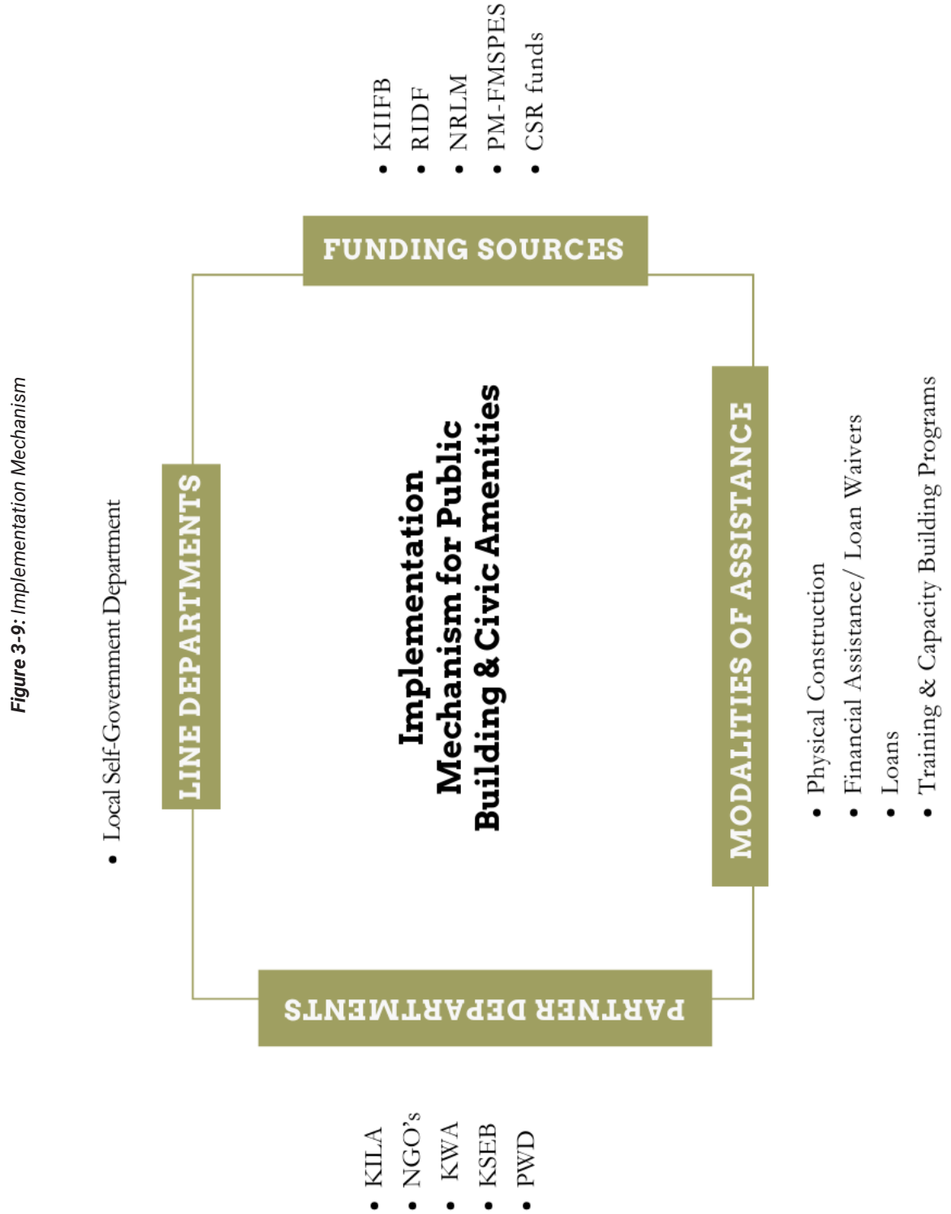


Figure 3-9: Implementation Mechanism



04



Education

4.1. Basic Profile of the Sector

The educational system in Wayanad District is characterized by a well structured and efficient governance model, with a single entity overseeing the entire system. The District Education Office, headed by a Deputy Director of Education (DDE), and supported by the District Institute of Education and Training (DIET), is responsible for the administration of a network of 306 schools, comprising 144 Lower Primary Schools, 68 Upper Primary Schools, 94 High Schools, 68 Higher Secondary Schools, 10 Vocational Higher Secondary Schools, and 6 Special Schools.

Additionally, the district is home to several Central Board of Secondary Education (CBSE) and Indian Certificate of Secondary Education (ICSE) schools, as well as a Kendriya Vidyalaya and a Jawahar Navodaya Vidyalaya, catering to the diverse educational needs of over 1 lakh students.

The Samagra Shiksha program is designed to achieve universal access to quality education by providing necessary infrastructure, ensuring equity and inclusion, promoting teacher development, and facilitating the acquisition of learning objectives. KITE (Kerala Infrastructure Technology for Education) Wayanad, a technology focused organization, provides essential IT-enabled services to support the educational process within the district. The effective implementation of instructional programs is overseen by state authorities, including the Department of General Education, SAMAGRA, KITE, and SCERT.

Some of the following facts are interesting to be learned from distribution of teachers in the Wayanad district:

- Across all stages, there are more female teachers than male teachers, reflecting a

Table 4-1: *The workforce - Number of teachers in schools*

Level	Government		Aided		Unaided (recognized)		Total	
	Male	Female	Male	Female	Male	Female	Male	Female
LP	292	626	166	575	36	338	494	1539
UP	434	581	357	529	69	263	860	1373
HS	356	417	234	351	14	47	604	815
HSS	303	359	143	206	14	39	460	604
Total	1385	1983	900	1661	133	687	2418	4331
Grand Total							**6749**	

broader trend and prominent in Lower Primary (LP) stage, where female teachers significantly out- number their male counterparts (1,539 females vs. 494 males).

- The number of teachers is more balanced between males and females, especially in the Higher Secondary School (HSS) stage, where male and female teachers are relatively equal in number.
- Similar to government schools, aided schools also show a higher number of female teachers, especially in the LP and UP stages.
- In the case of unaided schools, there is a noticeable drop in the number of male teachers, particularly in High School (HS) and HSS stages, with a small presence in the LP stage.

Wayanad district has experienced significant advancements in higher education. The district now boasts a network of over eight colleges offering graduate and postgraduate programs, three polytechnic institutes, two Industrial Training Institutes, four B.Ed. centers, and three teacher training institutes. Additionally, the district is home to an engineering college, a medical college, a nursing college, a veterinary college, and a college for hotel management and other management studies. Furthermore, the district benefits from the presence of three university centers affiliated with Calicut, Kannur, and Kerala Agricultural universities. The Kerala Veterinary and Animal Sciences University, located in Pookkode, Wayanad, is a prestigious institution with a sprawling campus accommodating over 3000 students and offering a diverse range of programs. This university has established collaborations with several renowned international institutions.

- There are a higher number of government schools in Wayanad compared to aided schools, particularly at the Lower Primary (LP) and High School (HS) levels.
- Aided schools are more prevalent at the Upper Primary (UP) level.
- The total number of schools is highest at the LP level, followed by HS and UP levels.

	Govt.	Aided	Total
LP	90	47	137
UP	21	41	62
HS	62	25	87
Total	173	113	286

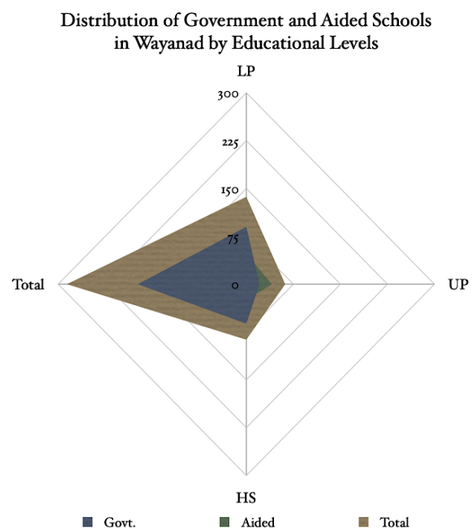


Figure 4-1: *Details of government and aided schools in Wayanad district (recognised schools are functioning in the district)*

4.2. Stakeholders and Schemes

Department of Education

The Department of Education plays a critical role in formulating and implementing education policies at the state and national levels. It ensures the alignment of state policies with national education goals and international commitments, such as the Sustainable Development Goals (SDGs). The department is also responsible for developing and monitoring curriculum standards, implementing teacher training programs, and overseeing the distribution of resources and infrastructure development in schools. The department also supports initiatives like the Mid-Day Meal Scheme under PM Poshan to enhance student enrolment and retention.

Grama Panchayat Education

Grama Panchayats play a significant role in supporting the educational initiatives at the grassroots level. They are involved in monitoring the functioning of schools within their jurisdiction. Facilitating the implementation of government schemes like Sarva Shiksha Abhiyan and the Mid-Day Meal Program. Mobilising community support for improving school infrastructure and student enrolment. Ensuring that marginalised and disadvantaged groups have access to education.

Samagra Shiksha Keralam

Samagra Shiksha is an overarching program for the school education sector, spanning from preschool to class 12. The program aims to ensure inclusive and equitable quality education for all by integrating three earlier centrally sponsored schemes. Samagra Shiksha's key objectives are to provide universal access to education and student retention; bridge gender and social category gaps in education; and enhance the quality of education through curriculum reforms, teacher training, and the introduction of digital learning tools. The total allotment for the current financial year is

District Institute of Education and Training (DIET)

Under the Department of General Education, DIET is a key institution at the district level responsible for improving the quality of education. They play a pivotal role in the training of teachers and other educational functionaries. DIETs focus on the following: providing pre-service and in-service teacher education; conducting research and innovation to improve educational practices; supporting the implementation of state and national educational programs at the district level; and acting as a resource centre for educational planning and administration.

Aspirational Districts Program (ADP)

The Aspirational Districts Program (ADP) is an initiative by the Government of India to accelerate the development of the most backward districts in the country. Education is one of the key focus areas under ADP. The program aims to transform these districts by improving indicators related to school education, such as: Student learning outcomes. Transition rates from primary to secondary education. Teacher availability and quality. Access to digital and physical infrastructure. ADP programs work with the principle of convergence, collaboration and competition.

The Aspirational Districts Block Program (ADBP)

ADBP is an initiative aimed at accelerating development at the block level within India's most underdeveloped districts. Building on the Aspirational Districts Program, ADBP focuses on micro-targeting key areas such as education, healthcare, agriculture, and infrastructure. By concentrating efforts at the block level, the program aims to address specific local challenges, promote inclusive growth, and ensure

Table 4-2: Baseline information of educational facilities in Wayanad District

Educational Facilities	Govt	Govt. Aided Education Facilities	Total	Number Of Students			Number of Teachers		
				Boys	Girls	Total	Male	Female	
Pre-Primary School	129	72	201	4871	4787	9658	26	175	
Primary School Independent 1- 4	87	41	128	7829	7384	15213	197	581	
Primary School Independent 1- 5	3	5	8	647	634	1281	17	42	
Primary School Independent 1- 7	21	37	58	16097	15895	31992	290	899	
Primary School Independent 5- 7	0	5	5	915	846	1761	18	55	
Secondary School 1 to 12	23	5	28	18326	17048	35374	360	844	
Secondary School 1to 10	19	1	20	10800	10648	21448	124	370	
Secondary School 5 to 10	1	0	1	544	504	1048	4	9	
Secondary School 6 to 10	1	0	1	149	151	300	5	10	
Secondary School 8 to 10	1	3	4	1174	1228	2402	35	57	
Secondary School 8 to12	8	11	19	9188	9910	19098	259	477	
Secondary School 5 to12	9	5	14	9213	8663	17876	248	479	
Secondary School 6 to 12	1	0	1	973	1047	2020	30	49	
1 To 12 with VHSE	3	1	4			0			
5 To 12 with VHSE HSS	3	0	3			0			
6 To 12 with VHSE and HSS	1	0	1			0			
8 To 12 with VHSE and HSS	0	1	1			0			
VHSS Only (Ths VHS Bathery)	1	0	1	211	20	231			
Total schools in the district	**311**	**187**	**498**	**80937**	**78765**	**159702**	**1613**	**4047**	

Table 4-3: *Educational Institutions in Meppadi*

Sl. No	School name	Boys	Girls	Total	Remarks
1	APJ, SALPS Kottappadi	31	34	65	
2	GLPS Chullikka	46	42	88	
3	GLPS Erumakkolly	19	16	35	
4	GLPS Meppadi	184	134	318	
5	St. Joseph's Girls HSS	0	428	428	
6	GHSS Meppadi	799	441	1240	
7	St. Joseph's UPS, Meppadi	730	735	1465	
8	GHS Thrikkaippetta	255	217	472	
9	GLPS Nedumabala	24	28	52	
10	GLPS Mundakkai	20	35	55	Excluding 19 pre-primary students
11	GLPS Puthumala	0	65	65	
12	GLPS Meenakshi Villas	25	23	48	
13	GVHSS Vellaramala	259	238	497	Excluding 88 students in VHSE
14	GLPS Kottanad	138	135	273	
	Total	**2530**	**2571**	**5101**	**5208**

that development reaches the grassroots. ADBP programs gathers CSR funds and special challenge funds from NITI Ayog in three four blocks Kalpetta, Panamaram, Mananthavady and Sulthan Bathery.

Kerala Infrastructure and Technology for Education (KITE)

KITE plays a pivotal role at the district level in enhancing the quality of education through technology integration. KITE is responsible for implementing and managing digital infrastructure in schools, including the deployment of smart equipment in classrooms and the introduction of e-learning tools.

4.3. Education Profile in Meppadi Grama Panchayat

The disaster that struck Meppadi Grama Panchayat had a profound effect on the region's educational and academic activities. Most of the schools, which had withstood the brunt of the damage, were quickly repurposed into makeshift relief camps, offering shelter to the vulnerable and homeless.

There are 14 government and aided schools in Meppadi Grama Panchayat. These schools are within the 20-kilometer range of Meppadi, including GLPS Mundakkai, and GHSS Vellaramala. The geographic terrain of this region, which is both inaccessible and prone to landslides, exacerbates the difficulties. The previous





Figure 4-2: *GVHSS Vellarmala before the Landslide*

landslides occurred particularly the 2019 event affecting GLPS Puthumala, resulting in the relocation of this institution. The current landslide caused total damage to GLPS Mundakkai and GHSS Vellaramala including their Pre-Primary and VHSE infrastructure which highlights the vulnerability of critical infrastructure like schools in this region. This underscores the urgent need for comprehensive disaster preparedness plans, relocation and reconstruction of schools.

4.4. Damages in the Sector

The baseline data for Wayanad's educational facilities indicates a broad distribution of schools, with primary schools (grades 1-7) enrolling a significant proportion of students. However, the student-teacher ratio, particularly in secondary schools, may require further optimization.

The devastating landslides had a significant impact on GVHSS Vellarmala and GLPS Mundakkai, including the vocational higher secondary section housed within GVHSS Vellarmala. The schools' infrastructure, including playgrounds, laboratories, libraries, IT labs, and vocational training facilities, was severely damaged. Additionally, a significant portion of the schools' equipment, books, and other learning materials were lost as a result of the landslide.

Impact of the Disaster in Education

The devastating landslide that struck Wayanad in 2024 has left an indelible mark on the region's education landscape. One of the most immediate impacts was the widespread destruction of school buildings. Two educational institutions, with all facilities particularly those located in hilly and remote areas, were severely damaged or completely destroyed by the landslide.

Beyond the immediate disruption caused by school closures and displacement, the disaster has triggered a cascade of challenges that threaten the educational prospects of the students of the region. Impacts of the damages and loss are as follows:

Lives lost:

One of the most devastating impacts of the landslide was the loss of life among children.

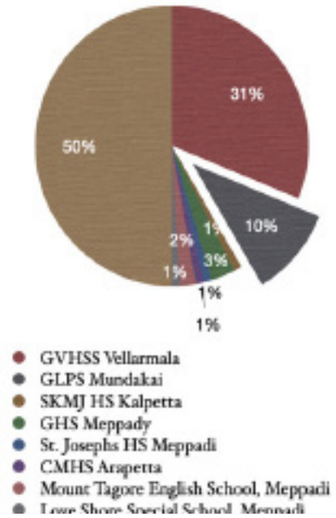
According to local reports, over 36 school children were killed in the disaster, 17 others still reported missing. The loss of these young lives has had a profound impact on the community, with grieving families and classmates struggling to cope with the tragedy. The emotional toll on surviving students and teachers has been immense, with many requiring ongoing psychological support.

GVHSS Vellarmala experienced the highest number of casualties, with 33 students killed or missing. This represents a significant loss, deeply impacting the school community and highlighting the severe nature of the landslide's impact in that area. The total number of students reported dead or missing is 53, not just in terms of numbers, but showing the potential impact on the community's emotional and psychological well-being.

School	Boys	Girls	Total
15217-G L P S Mundakkai	24	49	73
15036-GVHSS Vellarmala	259	238	497
912009-GVHSS Vellarmala (VHSE section)	68	20	88
Total	**346**	**293**	**658**

Table 4-4: *Damaged schools and number of students studied in the schools*

Figure 4-3: *Total number of Students Deceased/ Missing*



Total number of Students Deceased/ Missing

Name of the Schools Damaged	No. of Students deceased /missing
GVHSS Vellarmala	33
GLPS Mundakai	11
SKMJ HS Kalpetta	1
GHS Meppady	3
St. Josephs HS Meppadi	1
CMHS Arapetta	1
Mount Tagore English School, Meppadi	2
Love Shore Special School, Meppadi	1
Total	53

- GVHSS Vellarmala has the highest number of students affected, with 33 cases reported.
- Several other schools have reported cases, including GLPS Mundakkai, SKMJ HS Kalpetta, GHS Meppadi, and St. Joseph's HS Meppadi.

The loss of life is spread across several schools, with GLPS Mundakkai reporting 11 students killed or missing. Other schools, such as SKMJ HS Kalpetta and GHS Meppadi, reported fewer casualties, but the impact is no less tragic. Each of these losses represents a profound tragedy for the families, schools, and broader community.

The inclusion of Love Shore Special School for students with disability, Meppadi, where one student is reported missing or killed, underscores that the disaster affected vulnerable populations as well. This raises concerns about the adequacy of disaster preparedness and response for special needs institutions.

Learning loss:

The closure of schools in affected areas has resulted in a significant loss of instructional time. 40 days of schooling has been lost considering the local holiday declared by the collector prior to the disaster. Students, particularly those preparing for crucial examinations, are grappling with the uncertainty and stress caused by the disruption.

Loss of Access to Education:

Displaced students face significant challenges in accessing education. Many have lost their textbooks and study materials.

Sl. No.	Name of the schools damaged	Land Area Affected	Number of students
1	GVHSS Vellarmala	4 acres	585
2	GLPS Mundakkai	2.2 acres	73
	Total	6.2 acres	658

Table 4-5: *Total Students and Land Area affected by Landslide*



Figure 4-4: *GVHSS Vellarmala after the Landslide*

The lack of a stable learning environment further exacerbates their difficulties.

Infrastructure loss:

The recent landslide has resulted in significant damage to the school infrastructure, particularly impacting the laboratory building and two schools: Government Vocational Higher Secondary School (GVHSS) Vellarmala and Government Lower Primary School (GLPS) Mundakkai. The foundation of the laboratory building has been compromised, leading to the development of visible cracks in the walls and floor. The roof has suffered severe damage, with sections of it collapsing.

Furthermore, the instability of the surrounding area poses a significant risk of additional landslides, thereby endangering the safety of students and staff.

GVHSS Vellarmala, which serves 585 students, has suffered substantial damage, with 14 classrooms severely impacted. This extensive damage threatens to disrupt educational activities for an extended period. Similarly, GLPS Mundakkai has been severely affected, with significant portions of its land compromised.

In total, the education of 658 students has been entirely disrupted, highlighting the urgent need for immediate intervention and support to restore the learning environment.

Figure 4-5: *GLPS Mundakkai before the Landslide*



Loss of land:

This includes the complete loss of land in the lower sections of the institution where the ground has been swept away or destabilized.

The erosion has reduced the available land for school activities, making large portions of the campus unusable and unsafe for students and staff. This includes areas previously used for outdoor activities, assembly, and other school functions.

Loss of Playground Area:

100% of the playground has been completely eroded by the river. The affected area includes the main football field, running track, and portions of the volleyball and basketball courts in two schools. The playground was not only a critical facility for school activities but also served as a recreational space for the local community. Its loss had a considerable impact on both the school and the surrounding area.





Figure 4-6: *GLPS Mundakkai after the Landslide*

Loss of the library:

The loss of the school libraries, which housed a collection of over 6,700 books at GVHSS Vellarmala and 350 books at GLPS Mundakkai, constitutes a significant setback for the educational institution and the broader community. These libraries served as invaluable resources, supporting students' learning and research endeavors. Moreover, they provided access to books and educational materials to the local community. The loss of these libraries will have a profound impact on both the school and the community.

Equipment - loss and damage :

The storage facility, which housed equipment for various sports including football, volleyball, basketball, athletics, and badminton, was destroyed in the landslide. This included goalposts, nets, balls, rackets, track and field equipment, and other essential items used for physical education and sports training. The loss of this equipment has significantly impacted the ability to conduct regular physical education classes and extracurricular sports activities. These activities are crucial for the physical development and well-being of the students, and their suspension will have a detrimental effect on the overall school experience. A large portion of the science, computer and VHSE section's equipment's including computers, laboratory tools, and other essential devices, has been damaged or destroyed. The landslide caused flooding in the lab, leading to the malfunctioning of electronic equipment and the destruction of paper-based records and materials.

Psychological Impact:

The trauma experienced by students and teachers can have long-lasting effects on their mental health and well-being. This can manifest in decreased concentration, anxiety, and even post-traumatic stress disorder (PTSD), hindering their ability to engage in learning.

Sl. No.	Name of College	Deceased	Affected	Total
1	NMSM Government College, Kalpetta	2	11	13
2	Government College, Mananthavady	nil	2	2
3	St. Mary's College, Sulthan Bathery	nil	3	3
4	WMC Arts and Science college Muttil	2	10	12
5	Alphonsa Arts and Science College, Sulthan Bathery	nil	1	1
6	Eldho Mar Baselios College Meenanagadi	1	13	14
7	St. Gregorios Teacher Training College, Meenangadi	nil	1	1
8	Govt. Polytechnic College, Meenangadi	nil	1	1
9	Govt. Polytechnic College, Meppadi	1	4	5
10	SN University LCS NMSM Govt. College, Kalpetta	1	1	2
	Total	**7**	**47**	**54**

Table 4-6: *College Students Deceased and Affected by Landslides*

Sl. No.	Damaged Assets (Structures)	Totally Destroyed (Damages above 70%)	Roof type	No. of floors	Total Built area (sq. m.)	Height of building (m)	Description of the Damages
1	GVHSS- Vellarmala - Block 1	1	RCC	2	253.92	8	Fully damaged
2	GVHSS- Vellarmala - Block 2	1	RCC	2	415.8	8	Floor, doors and windows, plastering etc damaged
3	GVHSS- Vellarmala - Block 3 & 4	1	RCC	2	426.93	8	Veranda steps and flooring damaged
4	GVHSS- Vellarmala - Block 5	1	RCC	1	216.72	4	No damage
5	GVHSS- Vellarmala - Block 6	1	RCC	2	308.31	8	No damage
6	GVHSS- Vellarmala - Block 7	1	RCC	1	209.48	4.1	Fully damaged
7	GVHSS- Vellarmala - Block 8	1	RCC	3	319.2	11.6	Fully damaged
8	GVHSS- Vellarmala - Block 9 KIIFB	1	RCC	3	642.6	12	GF - Walls, doors and windows, floor damaged. No structural damages noticed
9	GVHSS- Vellarmala - Block 10 STAGE	1	RCC	1	48	5	Fully damaged
10	GVHSS- Vellarmala - Block 11 HALL	1	GI sheet	1	216	3.8	Fully damaged
11	GVHSS- Vellarmala - Block 12 KITCHEN	1	RCC	1	33.4	4	Fully damaged
12	GVHSS- Vellarmala - Block 13 TOILETS	1	RCC	1	54	3.6	Fully damaged
13	GLPS MUNDAKKAI BLOCK 1, MSDP Building	1	RCC	2	250	8	Partially
14	GLPS MUNDAK-KAI Block 1, MSDP Building- Single storeyed building	1	RCC with GI sheet	1	240.13	3.6	No damage
	Total				**3634.49**		

Table 4-7: *Distribution of (Structural) Damaged Assets*

Table 4-8: *Total Estimated Damages (Structural)*

Types of Assets	Total built up Area (Sq. Mt.)	Total Damages (in INR Cr.)
Primary School with Pre-primary section	490.13	1.225325
Secondary School with VHSE	3144.36	7.8609
Total	**3634.49**	**9.09**

Overcrowded classrooms:

The total destruction of the two schools will lead to overcrowded classrooms in neighbouring schools or the cancellation of classes, affecting the quality of education.

4.5. Landslide impacts on Higher Education

The incident resulted in the unfortunate loss of seven college students and injuries to 47 others (Report submitted to the HEM on 29.08.2024).

Table 4-6 shows data on the number of students affected by the landslide within the higher education sector. A total of 54 students were impacted, with 7 fatalities. Although no college buildings were directly affected by the landslide, a significant number of students, while commuting to and from various colleges, were tragically affected by the disaster.

4.6. Response of the Department of General Education

The Department of Education has been actively engaged in the response to the landslide that devas- tated portions of Wayanad on the early morning of July 30, 2024. The safety, well-being, and continued education of the students and families impacted by this calamity have been our immediate priority. Department's collaborative efforts offered psychological support, educational continuity, and alleviation to the affected communities, in partnership with teachers, non-teaching staff, and related organisations.

The Principal of DIET Wayanad was assigned by the Department to conduct a comprehensive Information Gathering and Survey in order to collect the necessary data and acquire, analyse for a status report. The SSK Wayanad and KITE platforms were employed to synthesize this data. An initial report was presented, which provided a comprehensive overview of the situation and the requisite interventions. This joint venture was very effective in getting a robust report at the initial stage. This survey was executed, three days after the incident. Out of 496 responses, a substantial majority of 89.5% indicated that students were reachable. The data suggested that communication lines, such as mobile networks, were largely functional, or alternate methods were effective in establishing contact with most students shortly after the disaster.

State-Level Coordination

An online conference was organised with the Minister of Education (Government of Kerala) to evaluate the post-disaster assistance that was provided to children. All educational officers in Wayanad were summoned to attend the online meeting on August 3, 2024, in anticipation of a state- level meeting on August 6, 2024.

The primary objective of this meeting was guaranteeing, all facets of the educational sector's response were thoroughly addressed. Hon'ble minister for Education, V Sivan Kutty visited the landslide site on 06.08.2024 and detailed guidance was given for the relief and rescue efforts pertinent to students.

Immediate Responses by the Teachers of the Schools

In the aftermath of the devastating landslide in Meppadi, teachers have demonstrated excep-

tional resilience and dedication in supporting their community. They have actively engaged in relief efforts, conducting regular visits to relief camps and affected households. To support the community's recovery, they have organized orientation programs to address the challenges posed by the disaster. Furthermore, they have successfully convened a PTA meeting via Google Meet, achieving a commendable 60% attendance rate, demonstrating their commitment to maintaining educational continuity despite the adverse circumstances.

In addition to their relief efforts, teachers visited hospitals to provide emotional support to injured students and staff. They also engaged with the families of affected individuals to assess their immediate needs and offer assistance. To bring joy to the youngest victims, the teachers distributed 100 toys to children residing in relief camps. Recognizing the psychological impact of the disaster, they provided mental health support to both parents and children, aiding them in coping with the trauma. Their unwavering support and proactive interventions have played a vital role in the community's ongoing recovery process.

Schools as relief camps

As a response to the event, several schools in the region were converted as relief centres in order to accommodate the affected population. This facilitated the affected population to stay together during the initial days in safer spaces.

The ***Table 4-9*** listing the number of students from various schools staying in relief camps indicates a response to the landslide. These camps started functioning on July 30, 2024, and continued until September 26, 2024, providing shelter. As a result, academic loss as mentioned earlier occurred not only in those damaged two schools, but in neighbouring schools as well. From the numbers, it's evident that schools like GHS and HSS Meppadi had a relatively higher number of students in the camps, with 78 students, indicating that this school was a major relief camp. The presence of multiple schools from Meppadi suggests that this area was particularly impacted.
The relief camps served an essential role in providing a safe space for students displaced or affected by the landslide. The spread across different schools highlights the community-wide impact of the disaster and the broad-scale

Sl. No.	Name of the schools	No. of students in the camp as on 4.8.2024
1	GLPS Meppadi	44
2	GHS & HSS Meppadi	78
3	St. Joseph HSS Meppadi	34
4	St. Jospeh UP Meppadi	40
5	Mount Tabore	38
6	SDMLP Kalpetta	12
7	GUPS Kottanad	34
8	CMS HSS Arappatta	25
9	De Paul Kalpetta	26
10	RC LPS Chundale	23
11	GHS Rippon	36
	Total	352

Table 4-9: *List of schools converted to relief camps*

efforts made to ensure the safety and care of children during such critical times.

The involvement of the Women and Child Development (WCD) Department in arranging "Kuttiyidam" and providing psychosocial support counselors for the children in the relief camps reflects a comprehensive and sensitive approach to disaster response. "Kuttiyidam," which can refer to a safe space or shelter specifically for children and women, ensures that these vulnerable groups have a secure and comforting environment. The details of this initiative is further elaborated in the chapter on psychosocial wellbeing.

The relief camps set up in response to the landslides closed on August 26, and during their operation, they provided essential support to children displaced by the disaster. Recognizing the importance of continuing education even in crisis situations, these camps supplied children with study materials, study kits, and uniforms to facilitate their learning journey amidst upheaval. This initiative not only ensured that the educational progress of students was not halted by their temporary displacement but also contributed to a sense of routine and normalcy for the children affected.

4.7. Priority areas of immediate recovery

School Reopening Preparation

An online meeting was conducted on August 5, 2024, with the Head teachers of schools that serve as relief sites along with State Resource Group (SRG) Conveners, and IT Coordinators. The Department directed these teams to make the requisite preparations to commence classes in schools that are not currently functioning as relief camps. This was a critical stage in the ongoing recovery process, as it helped to restore a sense of normalcy and stability for students.

The DIET and BPC Vythiri has conducted a detailed transport mapping for students affected by the landslide. The mapping identifies safe routes, schedules, and transport resources to ensure all displaced students have reliable access to alternate schools. Coordination with local transport authorities has been established to facilitate efficient student transportation.

SSK Wayanad successfully organized a Psychosocial Support Module Development Workshop to aid landslide victims. The workshop brought together a diverse team of experts, including ASPD, SPOS, DIET faculties, DPC, special educators, DDE, DEO, AEOS, trainers, NGOs, CRCs, teachers, psychologists, and educational experts from SCERT. The collaborative effort focused on creating tailored psycho-social support modules to address the mental health and well-being of affected students and families. These modules will be integral in the ongoing recovery process, ensuring comprehensive and compassionate care for the community.

The Department of Education has appointed the DDE Wayanad as the Special Nodal Officer to oversee and manage the post-disaster educational rehabilitation efforts following the recent landslide. In this critical role, the DDE will coordinate all activities related to the restoration and continuity of educational services in the affected areas. This includes liaising with local authorities, educational institutions, and relief agencies to ensure that all students have access to safe learning environments, psychological support, and necessary resources to resume their education without further disruption.

The collaboration between various departments, LSGDs, and the District Panchayat was essential in the effective management of rescue and relief efforts following the Meppadi landslide. This coordinated approach not only facilitated immediate responses but also laid a strong foundation for the ongoing educational rehabilitation of the affected areas. The success of these efforts underscores the importance of interdepartmental and intergovernmental collaboration in disaster management, particularly in ensuring that education remains a priority in times of crisis.(https://www.thehindu.com/news/national/kerala/psychological-support-programme-for-wayanad-landslide-survivors/article68577577.ece)

The ***Table 4-10*** detailing the makeshift arrangements in response to the landslide shows a comprehensive effort to maintain educational continuity and support for the affected students. Notably, two temporary schools were set up to replace those damaged by the landslide, ensuring that students could continue their education without significant interruptions. The distribution of 614 uniforms, educational kits, textbooks, and other materials signifies a

Table 4-10:*Items Needed for Makeshift arrangements*

Sl. No.	Items Needed	Units/No	Total Cost /unit
1	Temporary schools for the damaged schools	2	1,54,91,496
2	Uniform for the students	614	4,60,750
3	Educational kit	614	6,14,000
4	Text books and materials	614	3,07,000
5	Supporting kits-toys dress etc.	614	9,21,000
6	Travelling facilities to make shift school	605	2,11,75,000
7	Kitchen to make shift schools	2	50,000
8	VHSE LAB SECTION	1	18,03,715
9	Detailed study/survey of students in pre disaster & post disaster	1	5,00,000
10	Lab and Library	2 each	10,00,000
11	Sports equipment's	for 2 schools	25,00,000
	Total		**4,48,22,961**

well-organized effort to equip the students with the necessary tools for learning, reflecting an understanding of the critical nature of education in providing stability and normalcy.

Additionally, 614 supporting kits including toys and clothes were distributed, which likely helped in addressing the emotional and social needs of the children during this stressful time. The provision of travelling facilities for 605 students to these makeshift schools underscores the commitment to accessibility and inclusivity, ensuring that education remains within reach for all students despite logistical challenges posed by the landslide.

The establishment of kitchens within makeshift schools underscores the recognition of the significance of nutrition in facilitating learning and overall wellbeing. This holistic approach to student care is particularly crucial in challenging circumstances. Furthermore, the inclusion of a VHSE lab section demonstrates a commitment to the continuation of vocational education, which is essential for the practical and career focused development of students.

In the aftermath of the devastating landslide, the Department of Higher Education implemented a strategic initiative to mitigate academic disruptions and facilitate continued learning for displaced higher education students. To this end, help desks were established in all relief camps to provide necessary support and guidance. Furthermore, colleges swiftly transitioned to online classes to ensure uninterrupted education.

Recovery Vision

The vision is to build a resilient, inclusive, and sustainable education system in the aftermath of the landslide. In the immediate term, the educational department prioritize the safety and wellbeing of students and staff, the restoration of educational services, and the provision of psychosocial support. To address the physical and nutritional needs of children, the system will focus on providing adequate food and nutrition. In the short term, the department aim to construct disaster-resilient infrastructure, enhance teacher capacity, and integrate disaster risk reduction into the curriculum. Long-term efforts will focus on developing a robust, future-proof education system that fosters community resilience and ensures continuous professional development. The landslide will serve as a catalyst for the creation of resilient, eco-friendly schools and the adoption of innovative approaches, such as blended learning. Thus the ultimate goal is to ensure that every child, regardless of challenges, receives a quality education.

Resilience building among school children through School Safety

As the specter of climate change looms large, building resilience has become a paramount concern for Kerala. The state, actively upskilling and strengthening its systems and machinery to better handle the growing frequency and intensity of disasters, still faces the unpredictable nature of these events makes the state increasingly vulnerable, emphasizing the need for widespread comprehensive approach, one that prioritizes disaster literacy among all citizens.

As Nelson Mandela once said, "Education is the most powerful weapon which you can use to change the world," is particularly relevant in this context. Because, while we cannot control the forces of nature, we can certainly mitigate their impact through knowledge, awareness, and collective action. By integrating disaster risk reduction into the curriculum and fostering active participation in school safety programs, we can empower our citizens to be better prepared for future challenges.

National School Safety Guidelines 2016 formulated as part of the Disaster Management 2005, directs the schools to have a hazard assessment/ audit, school safety committee and school DM (disaster management)/ safety plan. A guideline in Malayalam – an abridged version of the national guidelines gives an annexure of the school DM plan template which captures the hazard list, emergency numbers etc. KSDMA has initiated and executed many programmes in the past, popularising and mainstreaming school safety activities, including the annual revision of the plan, in organising mock drills and awareness programmes. As a recent initiative in order to ensure the more considerable penetration of school safety activities for resilience building to all schools in Kerala, KSDMA developed an app in association with UNICEF along with technical support from CDIT and data support from KITE.

This webapp titled 'Uschool' (www.uschool.sdma.kerala.gov.in) is meant to aid all the focal point teachers and head teachers of the schools in the preparation of the School Safety Plan/ School DM plan as per Supreme court directive for ensuring school safety through the implementation of National Disaster Management Authority (NDMA) guidelines on School safety policy. The 'Uschool' app consists of a simple form structure with questions to be filled out, and some of the basic information about the school will already be available as provided by KITE. Teachers have to fill in the details and upload the hazard map and evacuation plan and get the school safety plan in a portable document format (pdf) to be printed and kept. It allows teachers to upload the school fitness certificate generated as part of the Kerala Education Rules and also the details about the active fire extinguishers in the school.

Ensuring school safety in all schools across Kerala is a continuing and ongoing process that needs much consideration and attention in the current context of increasing disasters caused by climate change. The Directorate of General Education has been doing its active role along with Kerala State Disaster Management Authorities and District Disaster Management Authorities in training and capacity building activities, as well as monitoring and reporting school safety status to the Ministry of Home Affairs and the National Disaster Management Authority every quarter.

However, active involvement in various capacity building activities by teachers, such as equipping children with DIET, SCERT, and SSK, is a requirement, as mentioned in the national guidelines. KSDMA had initiated such programmes through the State Institute of Education Management and Training (SIEMAT), Balasabha of Kudumbashree Mission and Kerala Youth Leadership Academy (KYLA). Easy clearance and solution of safety issues with the multi-department coordination through DDMAs and financial awareness about provisions and schemes to execute such activities are vital in bringing resilience to the education sector.

Awareness about early warning systems in place and do's and don'ts in the wake of various hazards are essential to be known by children, the future generation to manage multiple disasters.

4.8. Reconstructions and Recovery Needs Assessment

Immediate Recovery Phase (0-12 months)

Objective: Ensure the safety and well-being of all students, staff, and communities affected by the landslide while initiating the restoration of educational services.

Safety and Well-being

- Conduct a thorough assessment of all school buildings in the affected area for structural integrity.
- Declare unsafe school buildings arrange temporary learning spaces at GHSS Meppadi GLPS Meppadi and at the AAPJ community hall of Meppadi Panchayat.
- Provide psychological first aid and counseling services to students, staff, and families to mitigate the psychological trauma resulting from the disaster. Collaborate with relevant departments and experts to ensure the provision of comprehensive mental health support.
- Coordinate with local authorities/school staff to ensure all affected individuals have access to basic needs, including shelter, food, water, and medical care.
- Conduct rapid damage assessments to identify the extent of the impact on educational infrastructure.

Continuity of Education

- Establish temporary learning centres in safe locations in Neighbouring schools
- Distribute learning materials, such as textbooks, notebooks, and stationary, to students who lost their belongings in the disaster.
- Implement flexible learning schedules, including evening classes if needed, to accommodate students and teachers affected by the disaster.
- Postpone all term wise assessment in the affected schools.

Communication and Coordination

- Set up a dedicated communication channel/route for parents, teachers, and PTA, SMC etc. to share updates and receive support.
- Collaborate with local, national, and international organizations to secure resources for immediate educational needs.

Short-Term Recovery Phase (12-24 months)

Objective: Begin rebuilding infrastructure, restoring full educational services, and integrating disaster risk reduction into the curriculum.

Infrastructure Rebuilding

- Commence reconstruction of the two school buildings damaged during the recent disaster. The larger school will have a capacity of 500 students and a footprint of 3200 sq. m., while the smaller school will accommodate 200 students with a building area of 500 sq. m. Both schools will be rebuilt with a focus on incorporating disaster-resistant design principles in accordance with relevant building codes and safety standards.
- Provide temporary classrooms to replace any still unusable spaces, ensuring they are adequately equipped at GHSS Meppadi, GLPS Meppadi and at the AAPJ community hall of Meppadi Panchayat
- Restore utilities such as electricity, water, and sanitation facilities in schools.
- Educational Services Restoration, Educational Quality and Curriculum
- Resume full curriculum delivery with added support for students who may have fallen behind.
- Offer additional training for teachers to manage the aftermath of the disaster, including trauma-informed teaching practices.
- Develop and distribute supplementary learning materials focused on disaster awareness and preparedness.
- Integrate disaster risk reduction (DRR) education into the curriculum.
- Provide ongoing professional development for teachers, focusing on disaster preparedness and response, as well as psychosocial support.
- Implement programs to address learning gaps caused by the disaster, including remedial classes and tutoring.

- Develop and conduct community-based DRR programs, involving students, parents, and local leaders.
- Establish school-based disaster management committees to oversee preparedness activities.
- Develop or revise policies to ensure the education system is better prepared for future disasters.
- Establish partnerships with local and international organizations like to UNICEF to secure resources and expertise for ongoing recovery efforts.

Community Engagement and Support

- Organize community meetings to keep parents and local leaders informed about the recovery process.
- Engage local businesses, IAGs and humanitarian agencies to provide additional resources or volunteer support for schools.

Long-Term Recovery and Reconstruction Phase (24 to 60 Months)

Objective: Achieve a resilient, inclusive, and sustainable education system that is better prepared for future disasters.

Resilient Infrastructure

- Complete construction of all permanent school buildings with disaster-resistant features, ensuring they can serve as community shelters in future disasters.
- Install early warning systems and emergency supplies in all schools.

Educational Resilience

- Fully integrate disaster risk reduction education into the school curriculum, including regular drills and emergency preparedness exercises.
- Strengthen school-community partnerships to foster collective resilience against future disasters.
- Ensure ongoing professional development for teachers on disaster management and psychosocial support.
- Complete the construction of all permanent school buildings, ensuring they are designed to withstand future natural disasters.
- Build multipurpose structures with in schools that can serve as community shelters during emergencies.
- Install early warning systems and maintain emergency preparedness kits in all schools.

4.9. Recovery Principles

The recovery of Kerala's education sector in Wayanad post-landslide will be guided by principles ensuring a resilient, inclusive, and sustainable approach, rooted in established theoretical concepts and aligned with Kerala's unique socio-environmental context.

1. Building Back Better (BBB):

Reconstruction will aim for a stronger, more advanced system. This includes disaster-resistant infrastructure, modern technology integration for uninterrupted education, and eco-friendly practices utilizing renewable energy and efficient resource management.

2. Mainstreaming Disaster Risk Reduction (DRR):

DRR will be embedded in education planning, incorporating disaster preparedness into the curriculum, providing continuous professional development for educators, and maintaining up-to-date school safety plans with regular drills and functional early warning systems.

3. Convergence:

Recovery efforts will be coordinated across sectors. This involves collaboration between the education department, local governments, and disaster management authorities, leveraging public-private partnerships for resources and expertise, and engaging communities in the planning and implementation processes.

4. Inclusivity and Equity:

Recovery will ensure that all students, includ-

ing those from marginalized communities and those with disabilities, have access to quality education. Efforts will consider gender sensitivity, providing safe and supportive learning environments for girls and young women.

5. Resilience Building:

The education system will be fortified to withstand future shocks through adaptive learning models, community resilience initiatives, and continuous improvement via monitoring and evaluation mechanisms.

6. Transparency and Accountability:

Clear communication, participatory monitoring, and ethical resource management will maintain public trust and ensure efficient use of recovery resources.

7. Environmental Sustainability:

Recovery will prioritize sustainable construction, integrate environmental education into curricula, and promote biodiversity conservation, ensuring that rebuilding efforts do not harm local ecosystems.

These principles will guide recovery efforts, ensuring a stronger and more resilient education system in Wayanad.

The given table (following pages) outlines a well-rounded reconstruction and recovery strategy focused on disaster management, particularly in the aftermath of landslides, with a special emphasis on education and community resilience. This showcases a variety of initiatives aimed at supporting affected populations, especially students, while integrating long-term disaster risk reduction (DRR) measures to foster community resilience.

Reconstruction and recovery efforts highlight both immediate and long-term interventions. Programs such as the Mentoring Program and Career Guidance and Vocational Programs specifically cater to students who have been affected by landslides, ensuring they receive the necessary emotional, academic, and vocational support. These programs aim to bridge the gap between the immediate aftermath of the disaster and the long-term recovery of these students, offering pathways to regain stability and ensuring they have access to educational and career opportunities.

Focus is also given to educational infrastructure and preparedness measures. For instance, the Digital Museum and Virtual Interactive Point and the Higher Education Facilitation Centre with ODL Blended Learning Facility emphasize the importance of maintaining education continuity, even in times of crisis. These facilities enable students to continue learning while recovery efforts are ongoing, leveraging technology to provide virtual access to educational resources. This approach ensures that learning interruptions are minimized, even in the face of physical infrastructure damage.

Furthermore, the DRR initiatives mentioned in the table are integral to long-term recovery and resilience building. Measures such as Structural Safety Audits, School Safety Nodal Officers Training, and the development of School Safety Plans ensure that educational institutions are well-equipped to handle future disasters. By auditing the structural integrity of school buildings and providing safety training to key personnel, these initiatives prioritize the safety of students and staff, preventing future harm and ensuring preparedness for potential disasters.

In addition to school-specific measures, broader community-focused DRR initiatives, such as the Emergency Preparedness Plan, Early Warning Systems, and Public Awareness Campaigns are also outlined. These initiatives are vital for fostering community-wide resilience. Early Warning Systems, in particular, provide communities with timely alerts that can save lives, while public awareness campaigns educate the population about disaster risks and preparedness strategies, empowering individuals to take preventive action.

The Early Recovery measures, such as makeshift arrangements for temporary schools and virtual learning, play a crucial role in ensuring that education can continue even when permanent school buildings are damaged or unavailable. Temporary facilities like the temporary VHSE lab and arrangements for a School Safety Committee further emphasize the continuity of educational programs during the reconstruction phase.

Finally, the comprehensive breakdown of costs

__Table 4-11__ Reconstruction measures in the Education Sector

Sl. No.	Category	Reconstruction measures	No's	Size	Unit Cost for reconstruction	Cost Estimate	Total Cost (in crores)	Timelines
1	Primary School	Reconstruction of One Primary School of 250 sq. m. with provision of electricity, water supply, furniture and other equipment's	1	250	32875.5	8218875	0.822	3-12 months
2	Primary School	Provision of furniture, cupboards, educational materials, uniform for primary schools	1	1	614000	614000	0.061	3-12 months
3	Secondary School	Reconstruction of One Secondary School of 3500 sq. m. with provision for electricity, water supply, furniture and other equipment's	1	3200	32875.5	105201600	10.52	3-12 months
4	Secondary School	Provision of furniture, cupboards, educational materials, uniform for secondary school	1	17	20000	340000	0.034	3-12 months
5	Play ground	Reconstruction of two play grounds for new schools 5400 sq. m.	2	2500	1000	5000000	0.5	12 to 24 months
6	Pyscho-social Fitness centre	Psycho social counselling centre 250 sq. m.		250	35500	8875000	0.888	14 to 24 months
7	Physical fitness centre	Fitness centre 150 sq. m.	1	150	35000	5250000	0.525	12 to 24 months

Sl. No.	Category	Reconstruction measures	No's	Size	Unit Cost for reconstruction	Cost Estimate	Total Cost (in crores)	Timelines
8	Digital Museum and virtual interactive point	Digital Museum and virtual interactive point	1	500	35000	17500000	1.750	12 to 24 months
9	Higher Education facilitation centre	Higher Education facilitation centre with ODL Blended learning facility 250 sq. m.	1	250	35000	8750000	0.875	16 to 24 months
						Total	**15.975**	

Table 4-12 *Cost Estimate - Recovery measures in the Education Sector*

Sl. No	Category	Reconstruction and Recovery Measures	No's	Size	Unit Cost for recon-struction	Cost Estimate	Total Cost (in crores)	Time-lines
1	Academic recovery	Providing additional support as tutoring for 6 months bridge the learning gap of 44 days' Workshop for accelerated Literacy and Numeracy Development Reinforcement and Assessment for UP /Secondary schools Additional support for teachers during workshop Workshop for the learners for Application and Integration	all subjects			4898000	0.49	
2	Psychosocial Recovery programme	Additional support for the recovery psycho social systems of the individuals	for all students			4898000	0.49	
3	Mentoring Programme	Ensuring support for the victims of landslide affected for the next two years	for all students			2898000	0.29	
4	Career guidance and Vocational programmes	Ensuring career guidance and support for the programme for the survivals	for all students			3200000	0.32	
5	DRR	Structural Safety Audit	286	319	10000	2,871,000.00	0.287	17 to 24 months
6	DRR	School safety nodal officers -virtual cadre training	286	319	10000	3190000	0.319	24 to 60 months
7	DRR	Emergency Preparedness Plan	286	319	5000	1595000	0.160	25 to 60 months
8	DRR	School safety plan training SDM	286	319	1200	3,349,500.00	0.335	26 to 60 months
9	DRR	Early Warning Systems	286	319	50000	15950000	1.595	27 to 60 months
10	DRR	Public Awareness Campaigns	30	319	10000	4,000,000.00	0.4	28 to 60 months

Sl. No	Category	Reconstruction and Recovery Measures	No's	Size	Unit Cost for reconstruction	Cost Estimate	Total Cost (in crores)	Timelines
11	Early Recovery	Makeshift arrangement for the temporary school	2		15,491,496.00	15,491,496.00	1.6	29 to 60 months
12	DRR	Evacuation Drills	286	319		0	0.000	30 to 60 months
13	MAKE SHIFT	Temporary VHSE LAB	1			638000	0.190	31 to 60 months
14	DRR	School Safety Committee	286	319	2000	638000	0.064	32 to 60 months
		Sub-Total- Recovery					**6.35**	
		Grand total (Reconstruction & Recovery)					**22.325**	

and timelines (ranging from 12 to 60 months) in the table reflects a structured approach to recovery, where immediate needs are addressed while also laying the groundwork for long-term resilience and development. The detailed funding allocation for each initiative ensures that resources are effectively distributed to meet both short-term recovery goals and sustainable disaster preparedness objectives.

4.10. Resource Mobilization, Implementation, Monitoring & Evaluation

The success of disaster recovery and risk reduction (DRR) programs outlined in the ***Table 4-12*** requires a cohesive implementation strategy. This mechanism will ensure accountability, track progress, and allow for adjustments to be made when necessary.

The Department of Education will serve as the lead agency, coordinating with other departments to ensure the smooth execution of both immediate recovery efforts and long-term resilience building initiatives.

Formation of a Monitoring and Evaluation Committee (MEC) will be established under the leadership of the Department of Education, as it is the lead department for these programs. This committee will consist of representatives from Department of Education, Kerala State Disaster Management Authority (KSDMA), Public Works Department (PWD), Health and Social Welfare Department, Department of Information Technology, Local Self-Government Authorities, Ministry of Finance (State Level) and Independent disaster recovery experts, IAGs and NGOs.

The MEC will be responsible for overseeing the monitoring of program activities, collecting data, and reporting on the progress of each initiative.

• Department of Education (Lead Department)

Lead Role in Educational Continuity:
As the lead department, the Department of Education (Kerala) will oversee the design and implementation of programs related to school safety, mentoring, vocational training, and career guidance. The department will ensure that educational continuity is maintained through the establishment of temporary schools, digital learning centres, and virtual learning facilities.

Collaboration with National and State Bodies:
The Department of Education will work in close partnership with the Ministry of Education (India) to align its programs with national policies, particularly those related to Open and Distance Learning (ODL), as well as other educational initiatives. This collaboration will ensure consistency and access to resources across state and national levels.

Implementation of School Safety Programs:
The department will lead the efforts for school safety audits, training nodal officers, and evacuation drills in schools across the state. The department will also spearhead public awareness campaigns in schools, emphasizing the importance of disaster preparedness and ensuring that safety protocols are in place.

Vocational Training and Career Guidance:
In the aftermath of a disaster, the Department of Education will implement vocational and career guidance programs that provide affected students with pathways to regain stability in their education and future careers. This will include the establishment of Career Guidance and Vocational Programs that are aimed at helping disaster survivors develop skills for long-term recovery.

• Department of Disaster Management (Supporting Department)

Coordination with the Education Department:
The Kerala State Disaster Management Authority (KSDMA) will work closely with the Department of Education to implement disaster risk reduction programs in schools, particularly in terms of structural audits and emergency preparedness plans.

Early Warning Systems and Preparedness:
KSDMA, in coordination with the National Disaster Management Authority (NDMA), will provide technical support for the development and implementation of early warning systems in schools and communities, ensuring they are integrated with national disaster management efforts.

• Public Works Department (PWD)

Infrastructure Rehabilitation:
The PWD will be responsible for implementing structural safety audits of school buildings,

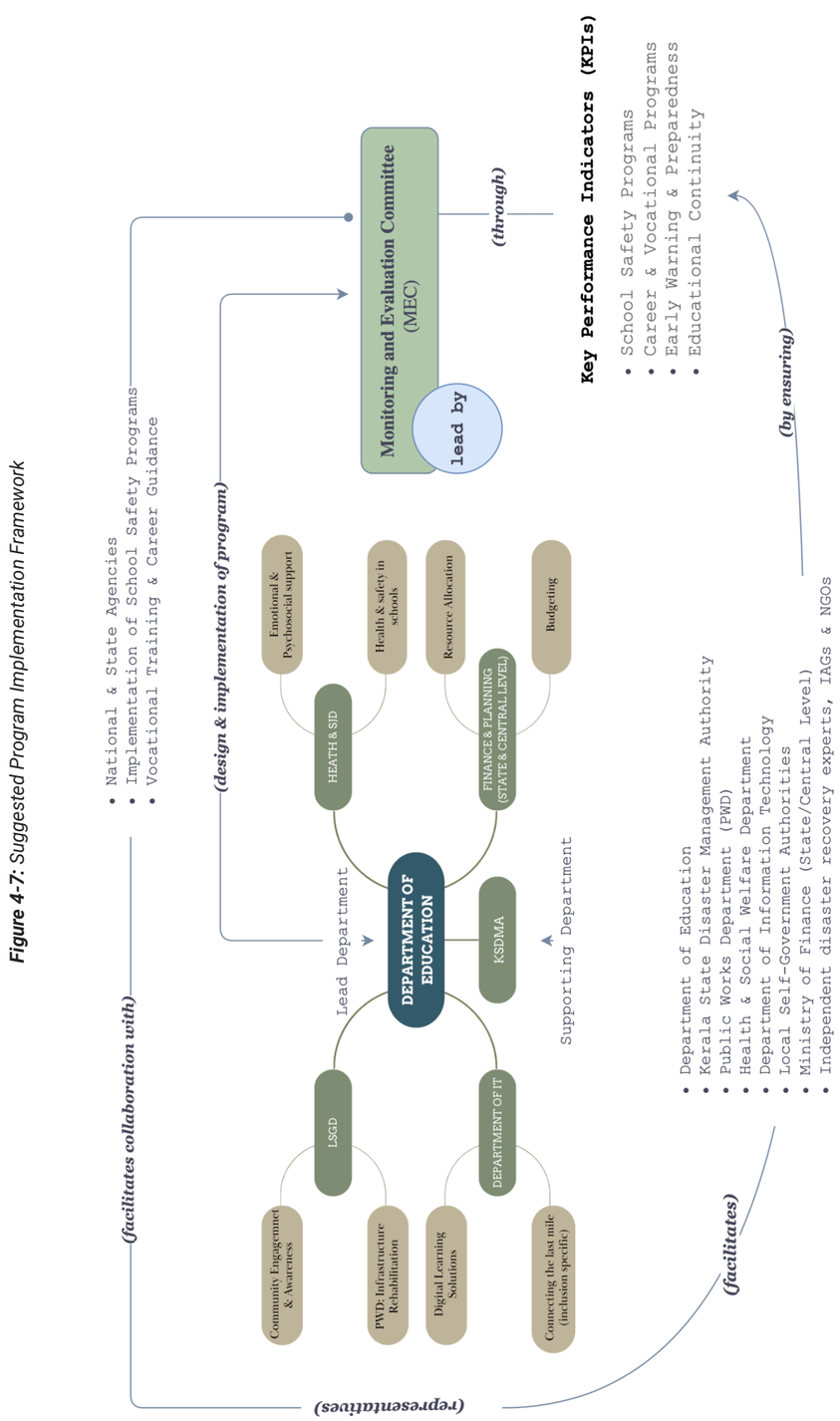


Figure 4-7: Suggested Program Implementation Framework

conducting necessary repairs, and ensuring the reconstruction of educational infrastructure damaged by landslides or other disasters.This will include retrofitting school buildings to meet disaster-resilient standards as part of the long-term recovery strategy.

• Health and Social Welfare Department

Emotional and Psychological Support:
The Department of Health and Social Welfare will partner with the Department of Education to implement counseling and mentoring programs aimed at providing emotional and psychological support to students affected by disasters. These efforts will help address trauma and ensure students' well-being throughout the recovery process.

Health and Safety in Schools:
The department will also ensure that health and safety standards are met in temporary schooling facilities, in collaboration with school authorities and safety committees.

• Department of Information Technology

Digital Learning Solutions:
The Department of IT, working under the guidance of the Department of Education, will implement the Digital Museum and Virtual Learning Centres for disaster-affected students.These facilities will provide online and blended learning platforms, ensuring that students have access to educational resources while physical infrastructure is being rebuilt.

• Home Department (State and Central Level)

Emergency Response Coordination:
The Home Department, including state police and fire services, will work with the Department of Education to ensure schools and educational facilities are part of disaster preparedness drills and evacuation protocols. The Home Department will also ensure that community safety initiatives are implemented at the school and local level.

• Department of Local Self-Government

Community Engagement and Awareness:
Local government bodies will collaborate with the Department of Education to conduct public awareness campaigns aimed at educating the broader community on disaster risks and preparedness. This department will also be involved in coordinating grassroots efforts, particularly around the development of temporary learning facilities in disaster-affected areas.

• Ministry of Finance and Planning (State and Central Level)

Resource Allocation and Budgeting:
The Finance Department will ensure that adequate funding is allocated for the recovery and rebuilding of educational infrastructure, vocational programs, and safety initiatives. In collaboration with the Department of Education, it will track the budgetary needs and ensure funds are distributed appropriately to ensure smooth program implementation.

Development of Key Performance Indicators (KPIs)

For effective monitoring, the MEC will develop Key Performance Indicators (KPIs) for each activity listed in the table. These KPIs will be based on measurable outcomes, timelines, and the success of specific interventions. The KPIs can be divided into short-term and long-term indicators.

Example of KPIs:

School Safety Programs:

- Number of schools with completed structural safety audits
- Number of nodal officers trained in safety protocols
- Number of school safety committees formed and functioning
- Number of evacuation drills conducted

Career and Vocational Programs:

- Number of students enrolled in mentoring and career guidance programs
- Number of vocational training workshops conducted

Early Warning and Preparedness:

- Functionality of early warning systems in schools and communities
- Public awareness campaign outreach

Educational Continuity:

- Number of students utilizing temporary school facilities or virtual learning centres.
- Number of students with continuous access to higher education facilities (via ODL).
- Percentage of students who return to school post-disaster

WAY FORWARD

The implementation of disaster recovery and risk reduction programs requires a comprehensive, coordinated approach that involves multiple government departments, community stakeholders, and external experts. The Department of Education, serving as the lead department, is central to ensuring the continuity of education, vocational training, and school safety programs. A well-designed monitoring mechanism, based on clear KPIs, real-time data tracking, and regular review processes, will ensure that all activities are on track and can adapt to challenges as they arise.

Through collaboration between state and central agencies, and with strong community involvement, this integrated framework will not only aid in the immediate recovery from disasters but also build long-term resilience, ensuring the safety, well-being, and continued education of vulnerable populations in Kerala. This approach ensures accountability, promotes transparency, and empowers the community to actively engage in disaster preparedness and recovery efforts.





Health and Nutrition

5.1. Basic Profile of the Sector

Wayanad's unique geographical and demographic profile presents significant public health challenges. With extensive forest cover and high rainfall, the district is vulnerable to climate related health risks, including human-animal conflicts, zoonotic diseases and waterborne illnesses. The district's substantial tribal population, which accounts for nearly 20% of the total population which is significantly high compared to that of the State's rate (1.5%), and particularly vulnerable to malnutrition and other health issues.

The district's geographical isolation and limited infrastructure, particularly in terms of transportation and healthcare, exacerbate these challenges. According to the National Family Health Surveys (NFHS), the tribal population in Wayanad exhibits the lowest nutritional indicators in the state, with alarmingly high rates (50%) of stunting among children. Communicable diseases, such as dengue, leptospirosis, and cholera, are endemic in the region. Additionally, Wayanad is a known endemic area for Kyasanur Forest Disease (KFD), a potentially pandemic disease. The Integrated Disease Surveillance Programme (IDSP) data for the period 2018-22 provides further insights into the district's disease burden (Table 5-1).

Wayanad, a geographically isolated district in Kerala, has historically faced significant challenges in accessing healthcare services. Its unique topography and limited transportation infrastructure have hindered the delivery of quality healthcare to its residents. Despite these challenges, the district has made significant strides in improving healthcare access particularly since its inclusion in the Aspirational Districts Programme in 2018 and with the emergence of new public and private healthcare facilities, the population now has better access to medical care (Wayanad is the only district in Kerala selected for the Aspirational District Programme (ADP) by NITI Aayog).

The Kerala government's 'Aardram' healthcare mission part of Nava Keralam Karma Padhathi scheme, has further accelerated the development of healthcare infrastructure in Wayanad.

Communicable diseases	2018	2019	2020	2021	2022
Malaria	18	15	6	8	5
Chikungunya	1	1	0	0	0
Dengue Fever	48	177	49	32	88
Fever	167663	179725	68974	59484	165434
Acute encephalitis syndrome	2	nil	1	0	1
Japanese Encephalitis	0	nil	0	0	0
Leptospirosis	114	83	158	111	424
Hepatitis A	57	60	15	9	3
Hepatitis - B	7	7	7	9	28
Cholera	2	5	0	0	0
Typhoid	1	2	0	3	0
Scrub Typhus	43	61	27	20	27
Acute Diarrheal disease	19726	22136	10259	7987	18996
Hl N1	22	37	0	0	4
Nipah	nil				
Kyasanur Forest Disease	0	0	29	4	1
Diphtheria	nil	3	0	0	0
Chickenpox	nil	1732	981	215	477
Rabies	0	0	2	0	0
Hepatitis C	nil	nil	nil	3	2
Shigella	0	0	0	12	0

Table 5-1: *Data on Communicable Disease, Wayanad of the year 2018-22*

Table 5-2: Baseline information on public health facilities in a District

Type of Medical Facilities	Total Number of Public Health facilities	Average number of clients per day	
		Male	Female
Health Centre			
Primary Health centre	23	35	50
Community health centre	8	100	150
Others			
Hospitals			
Medical College and Empanelled Hospital	1	560	840
District Hospital	1	350	400
Sub Divisional/Sub District Hospital/ Taluka Hospital	2	249	298
Ayurveda and Homeo hospitals and dispensaries	33		
Others	1	43	45
Other facilities			
Anganwadi centres	876		

This initiative aims to upgrade existing facilities and enhance healthcare delivery across the state. The baseline information of public health facilities in Wayanad is shown in ***Table 5-2***.

5.2. Sectoral Policies

Kerala, renowned for its exemplary public health achievements, including the lowest Infant Mortality Rate (IMR), Maternal Mortality Ratio (MMR), and the highest life expectancy in India, has maintained its leading position in the NITI Aayog's Sustainable Development Goals (SDG) India Index 2023-24. To further optimize its healthcare system, the state has launched the 'Aardram' mission, a comprehensive initiative designed to consolidate various health programs and initiatives.

Some policies and programs particularly relevant to the Wayanad district are detailed below.

One Health

The elements of climatic vulnerability, proximity to wild animals and marginalization of the community make the district more prone to biological disasters including zoonotic diseases and vector-borne diseases, human-animal conflicts, and malnutrition. A significant proportion of bats collected from the district tested positive for Nipah virus antibodies, and monkeys and rodents were identified as carriers of monkey fever (KFD). The community is under constant surveillance for these diseases along with endemic diseases like Dengue, Leptospirosis (Rat fever) and Cholera.

The One Health approach in the state is supported by veterinary universities. One of the two campuses of the university (Kerala Veterinary and Animal Sciences University) is located in Wayanad district and is actively involved with outbreak management and integrated surveillance targeting ticks, monkeys, and humans through its initiative - Centre for One Health Education, Advocacy, Research, and Training (COHEART). The implementation of the One Health (OH) initiative in Wayanad, which focuses on multisectoral collaboration among regional institutions in public, animal, and environmental health domains, is a successful and impactful endeavour.

Tribal Health Initiatives

The health of the tribal population in Wayanad, which constitutes a significant proportion of the district's population, is a matter of critical concern. These communities face unique health challenges, including socio-cultural barriers and difficulties in accessing healthcare services due to their remote and often inaccessible locations. To address these challenges, several initiatives have been implemented to improve healthcare delivery in tribal areas.

Tribal ASHA:
They are female members, hailing from tribal communities of Wayanad, who have undergone rigorous training to serve as a bridge between their communities and the public health system. Their role is particularly critical in enhancing access to healthcare services, especially in areas characterized by limited facilities and resources.

Mobile Medical Units:
Nine Mobile Medical Units and one mobile mental health unit for tribes are functioning within the district which are being managed by the health and tribal departments. The purpose of these mobile units is to facilitate the medical camps in tribal areas.

Janani-Janma Raksha:
One of the primary challenges in the realm of tribal health is maternal and child malnutrition. To address this issue, the scheme has been implemented to provide timely financial assistance of INR 1,000 per month for a period of 18 months, commencing from the third month of pregnancy and continuing until the child attains the age of one year. This financial support is intended to enhance access to prenatal and postnatal care, as well as nutritious food. Payments will be disbursed directly to the beneficiaries' bank accounts.

Medical Assistance through Hospitals:
The scheme is designed to provide comprehensive medical care to individuals belonging to Scheduled Tribe communities by facilitating treatment in selected hospitals across the state. The allocated funds will be utilized to defray the costs of medications, medical examinations (including a range of diagnostic scans), medical aids and equipment, and ambulance transportation services.

Nutritional Services

Wayanad, with its significant tribal population, is characterized by a high prevalence of nutritional morbidities. Further the socio-economic factors and limited access to healthcare contribute to the high rates of malnutrition, particularly among vulnerable populations.VIVA *(Vilarchayilninnum Valarchayilakku)* meaning, 'from anaemia to development' is a campaign by the State Government which aims to address anemia and improve the overall nutritional status of the population. To address the issue of anemia, Wayanad has implemented a rice fortification program. This initiative involves the fortification of rice with iron to enhance the nutritional value of the staple food.

Integrated Child Development Services (ICDS):
The comprehensive national program is designed to address the holistic development of children under the age of six. The program offers a range of services, including supplementary nutrition, healthcare, and early childhood education. Recognizing the strong link between maternal and child health, ICDS extends its services to adolescent girls, pregnant women, and lactating mothers. In the context of Wayanad, a district characterized by a significant tribal population and challenging geographical terrain, ICDS has implemented targeted interventions to address the specific nutritional needs of vulnerable groups.

Non-communicable Diseases, Elderly Care and Palliative Care:
Kerala is currently experiencing an epidemiological transition, characterized by a shift towards

chronic non-communicable diseases, including diabetes, hypertension, respiratory illnesses, and mental health challenges. In response to this trend, the state's health policy has prioritized addressing these challenges. NCD clinics have been established in all Family Health Centers (FHCs), and regular screenings are conducted at Health and Wellness Centers (HWCs). Furthermore, essential medications are being provided free of cost. Recognizing the increasing number of elderly individuals, Kerala has placed significant emphasis on community-based palliative care initiatives, which are actively implemented in all districts, including Wayanad.

In Kerala, all local self-governments must earmark at least 5% of the plan fund for the care of senior citizens and there should be a dedicated programme for the community-based palliative care services funded by the local self-governments.

Injuries, Trauma Care and Emergency Care

Injuries, trauma and Emergency Care are a priority for Wayanad because of the high chances of natural calamities and human-animal conflicts. But the facilities to address these challenges are rudimentary. The Government Medical College of the district is in its infancy, and currently, people residing in the district are compelled to use facilities available in the neighbouring districts. The district's mountainous terrain and limited infrastructure, coupled with its vulnerability to landslides and other natural calamities, pose significant challenges to the timely delivery of emergency medical services. To address these limitations, the government has initiated a policy to strengthen the medical college and other healthcare facilities within the district.

Assistance for Sickdecell Anaemia Patients

Sickle Cell Anemia is a hereditary blood disorder that predominantly affects the tribal communities of Wayanad, Palakkad, Kozhikode, and Malappuram districts. Individuals afflicted with this condition often experience chronic pain, mental stress, fatigue, and malnutrition. To alleviate the financial burden and improve the quality of life of these individuals, the government has introduced a scheme providing monthly financial assistance of INR 2500 for tribal patients and INR 1000 for others. Additionally, nutritional supplements in the form of pulses are being distributed to all sickle cell patients. To facilitate early detection and management of the condition, the health department has initiated new-born screening for sickle cell disease in Wayanad district.

5.3. Health and Nutrition Facilities in Landslide the affected areas

The landslide resulted in significant damage to two Health and Wellness Centers and three Anganwadis located in Chooralmala and Mundakkai. These facilities [***Table 5-3***] provided essential healthcare and early childhood development services to the local community. However, owing to the displacement of the population, the restoration of these facilities in their original locations are not feasible.

The HWCs in Chooralmala and Mundakkai served two tribal settlements, with a total population of 80 individuals. These facilities provided a range of essential healthcare services, including prenatal care, women and child healthcare, and treatment for non-communicable diseases [***Table 5-3***].

Nutrition plays a critical role in promoting overall health and well-being, and in reducing the risk of chronic diseases. A balanced diet rich in essential nutrients is instrumental in strengthening the immune system, maintaining a healthy weight, and improving mental health. To prioritize proper nutrition, three Anganwadi centers in Chooralmala, Mundakkai, and Attamala were actively supporting the communities by providing essential services to pregnant and lactating women, children under six years of age, and adolescent girls.

Further the Anganwadi centers provided vital services to pregnant and lactating women, children up to six years of age, and adolescent girls. By offering supplementary nutrition, health check-ups, and early childhood education, these centers played a crucial role in ensuring the nutritional well-being and holistic development of these vulnerable groups [***Table 5-3***].

5.4. Damages in the Sector

The Health and Wellness Center (HWC) in Mundakkai, which was closely integrated with the local Anganwadi, suffered significant damage. Owing to the displacement of the population, the

Table 5-3: *Monthly Services by the HWCs in the Affected Area*

Year: 2024	Month: April					Printed Date: 28.08.2024 11:36 A.M				
Category	Pregnancy related services					Children		Women	NCD	
Health Sub Facility	Pregnant Woman registered	AntiNatal Check-ups	TT vaccinations	Iron Folic Acid	Post Natal Check-ups	Children Registered	Fully vaccinated	Registered for Iron and FA tablets	Individuals under treatment for Hypertension	Individuals under treatment for Diabetes
Chooralmala	2	2	2	2	2	45	43	20	90	98
Mundakkai	6	6	6	5	6	17	16	12	14	12

Table 5-4: *Basic Profile of the Anganwadi's in the Affected Areas*

Population	Category/Age	Chooralmala	Mundakkai	Attamala	Total
Women & Mothers	Pregnant Women	6	6	6	18
	Lactating Mothers	12	2	4	18
Children	0-6 months	12	2	4	18
	6 m -3 yrs.	33	16	20	69
	3-6 yrs.	44	28	38	110
Adolescent Girls	11-14 yrs.	4	27	2	33
	14-18 yrs.	31	20	26	77



Figure 5-1: *The private dispensary at Chooralmala(- Dated: 29.08.2024)*



Figure 5-2: *Anganwadi in Attamala*



Figure 5-3: *Damaged ration shop at Chooralmala*

existing infrastructure cannot be utilized. Similarly, the HWC in Chooralmala, while structurally sound, is affected by the partial displacement of the population.

The landslide resulted in the complete destruction of three Anganwadi centers in Chooralmala, Attamala, and Mundakkai. Due to the displacement of the population, these facilities are considered to be irreparably damaged. ***Figure 5-1*** depicts the current state of the Attamala Anganwadi building. In addition to these public health facilities, a private clinic [***Figure 5-2]*** operated by Harrison Malayalam Estate, which offered laboratory services and regular medical consultations, was also adversely affected. The clinic, located in close proximity to a stream that altered its course due to the landslide, is no longer accessible to the displaced population.

The landslide resulted in the disruption of Ayurveda and Homeopathy - AYUSH services provided through government run mobile clinics. Additionally, two ration shops, serving a combined total of 1,862 cardholder families, were adversely affected. One of the ration shops was completely destroyed [***Figure 5-3***], while the other, located in a hazard zone, is no longer operational.

The list of damaged food grains and other materials stored at the ration shops and are listed in ***Table 5-5***.

Sl. No.	Items	Quantity
1	Raw rice	2567 kg.
2	Parboiled rice	10901 kg.
3	Matta rice	2711 kg.
4	Wheat	1368 kg.
5	Wheat flour	296 kg.
6	Kerosene	100 Litre
List of food items stored and damaged at ARD 2262046		
1	Raw rice	2684.3 kg.
2	Parboiled rice	9479.3 kg.
3	Matta rice	2121.5 kg.
4	Wheat	1060 kg.
5	Wheat flour	198 kg.
6	Kerosene	4.5 Litre
7	Sabari red chili powder	1.3 kg.

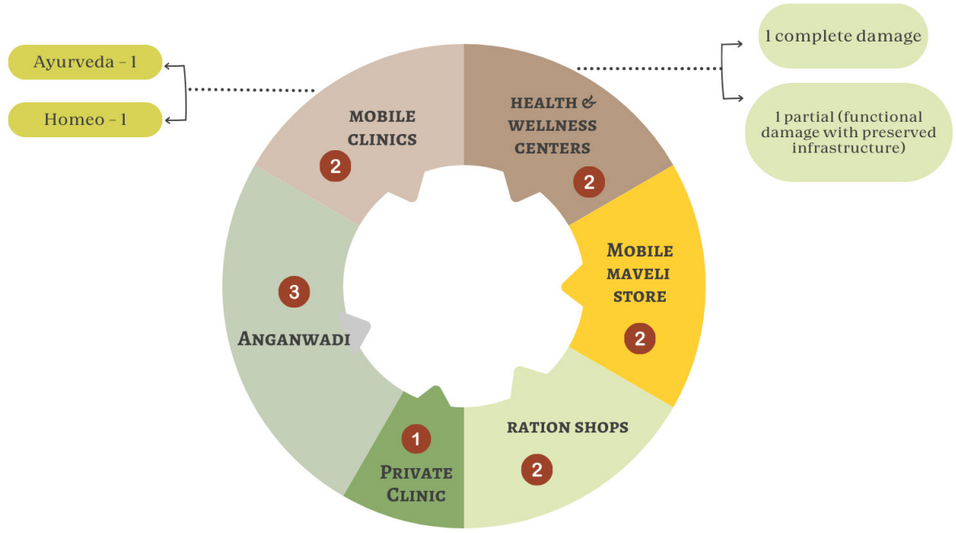
Table 5-5: *List of food items/materials stored and damaged at ARD 2262044*

Table 5-6: *Overall Damages/loss Cost Estimate*

Sector	Assets	Ward no.	Damage	Loss	Total Damage Estimate (in Crores)	Total Loss Estimate (in Crores)
Health	Private dispensary	10	Partial	Nil	INR 0.05	nil
	Private Laboratory	10	Partial	Complete (Lab equipment's and reagents)	INR 0.02	INR 0.02
	Private Pharmacy	10	Partial	Complete (Storage mechanisms and drugs)	INR 0.02	INR 0.02
	HWC	11	Partial	Complete (Equipment's)	INR 0.05	INR 0.05
Nutrition	AWC	10	Partial	Complete (Food items and toys)	INR 0.05	INR 0.05
	AWC	11	Partial	Complete (Food items and toys)	INR 0.05	INR 0.05
	AWC	12	Partial	Complete (Food items and toys)	INR 0.05	INR 0.05
	Food and civil supplies (ration shops)	10	One complete and the other partial	Complete loss in both the rationshops	NA (As the damage is calculated under commercial infrastructure)	INR 0.18
	Losses incurred to the health department as a response to the disaster (on account of purchase of medicines, post-mortem services, medical waste management)		nil	nil	nil	INR 0.37
	Grand Total				**INR 0.29 Cr.**	**INR 0.79 Cr.**

**Notwithstanding the partial damage to some health and nutrition infrastructure, the complete displacement of the population renders these facilities unusable. As a result, the entire infrastructure will be considered a total loss.*

Figure 5-4: *Total Damages to Health and Nutrition Sector*



A mobile Maveli store, operated by the civil supplies department, provided essential food grains and other food materials to remote and difficult to reach areas of the locality. However, due to the impact of the landslide, this essential service has been disrupted and may not be reinstated in the affected areas.

The damages to institutions in health and nutrition sector are showed in ***Figure 5-4.***

Economic Losses in the Sector

The estimated damage to the food and nutrition security sector, including health centers and Anganwadis amounts to INR 1.08 crores. This figure encompasses both physical damage to infrastructure, estimated at INR 29 lakhs, and losses due to damaged or discarded food grains, estimated at INR 79 lakhs. While the damage to ration shops is classified under commercial infrastructure, the impact on food grain stocks falls within the purview of the food and nutrition security sector.

Socio-Economic impact on People

The unprecedented rainfall in July 2024 resulted in devastating landslides in the Meppadi Grama Panchayat of Vythiri Taluk, Wayanad district.

These landslide had a significant impact on the public health infrastructure in the affected areas, resulting in substantial damage to facilities and disruptions to essential services. This has led to both immediate and long-term health consequences for the population. The affected areas, such as Punchirimattam, Mundakkai, Attamala, and parts of Chooralmala, rely heavily on preventive and promotive healthcare services to address their specific health needs.

The landslide resulted in the displacement or loss of life of all beneficiaries in Punchirimattam, Mundakkai, Attamala, and parts of Chooralmala. As a result, the remaining infrastructure and materials in these areas are no longer functional. Therefore, the damage to health and nutrition services should not be solely assessed based on physical infrastructure, but also on the broader impact on the displaced population.

The landslide was a devastating event that resulted in a significant loss of life, injuries, and severe psychological distress among the affected population. The data on fatalities [***Table 5-7***], as provided by the Department of Health highlights the extent of the human cost of the disaster.

The official death toll may underestimate the true number of fatalities, as it may not account for potential deaths among migrant workers, visitors, and tourists. According to triangulated

Table 5-7: *Details on Dead Bodies and Body Parts Examinations in Meppadi landslide*

Category	Number
Total number of dead bodies retrieved	231
Women	92
Men	103
Children (<18 years)	36
Body parts retrieved	221
Total post mortem examinations conducted (dead bodies and body parts)	**452**

data from the Department of Health, at least 359 individuals perished in the Meppadi landslide, (Date: 09/09/2024).

5.5. Response by the Government

In response to the devastating landslide that struck Mundakkai village in Wayanad district in the early morning of July 30, 2024, the Department of Health swiftly implemented a series of critical initiatives to address the emergency. Recognizing the urgency of the situation, district-level call centers were promptly established, with additional support from a state-level helplines at the Directorate of Health Services in Thiruvananthapuram.

Given the anticipated high number of casualties, the Family Health Centre in Meppadi was designated as the primary facility for conducting on-site post-mortem examinations and coordinating health care activities in the camps and field.

Immediate interventions

- The critical care of the injured survivors was adeptly managed at DM Wayanad Institute of Medical Sciences (WIMS), Meppadi.
- Medical camps were established at Rippon, SKMJ School, and De Paul School Kalpetta under FHC Meppadi and GH Kalpetta.
- The medical staff, including government doctors, provided continuous service at the camps from morning to night.
- The health department took decisive action to guarantee the continuous availability of medicines and medical supplies across all relief camps and at FHC Meppadi.
- A cardiologist performed two echocardiograms at the medical camp.
- A mobile ophthalmic unit, supported by the Rotary Club, supplied spectacles to 136 patients who had lost theirs during the landslide.
- The Director of Medical Education deployed an Assistant Professor to Mananthavady Medical College from Calicut Medical College to fulfil the emergency medical requirements.
- Human resources, medicines, and all necessary equipment were provided to all camps.
- The Kerala Government Medical Officers' Association (KGMOA) and Indian Medical Association (IMA) played an active role in supporting the district medical office and health department, ensuring the participation of numerous doctors to manage the emergency effectively.

Activities to prevent Infectious Diseases

- A health risks and needs assessment was conducted in the area.
- Animal carcasses were buried observing strict infection control protocols.
- Leptospirosis (rat fever) prevention was ensured for all persons engaged in rescue operations and persons affected by the landslide and flash floods.
- The medical teams deployed to all relief camps.
- An adequate supply of ORS-Zinc, bleaching powder, Doxycycline and other essential medicines are ensured. More drugs were mobilized to Wayanad from other warehouses.
- Super chlorination of water sources was done in affected areas to prevent waterborne diseases.
- Intensified vector control measures were taken in all relief camps and surrounding areas.
- Persons reporting symptoms of airborne infectious diseases were isolated in relief camps.
- Sanitation and waste management were ensured in all relief camps

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Review by Health Minister

The health minister Smt. Veena George conducted reviews systematically to oversee the emergency management updates, the treatment progress of survivors, the availability of medicines and medical supplies, the procedures for managing the deceased, and the execution of the action plan and the human resource management plan.

Dead Body Management

A significant proportion of dead bodies and body parts were retrieved from the Chaliyar River in the neighbouring district of Malappuram. Post-mortem examinations were performed at the District Hospital in Nilambur with the help of forensic surgeons from Government Medical College Manjeri, Government Medical College Thrissur, and forensic surgeons mobilized from other parts of Malappuram and other districts of the state.

The bodies and body parts were transported to Meppadi soon after the examinations. For the bodies and body parts retrieved from the site of the disaster, the examinations were conducted by the forensic surgeon in Wayanad and personnel from Government Medical College Hospital Kozhikode. The post-mortem examinations extended into the late hours of the night, continuing until 04:00 AM. This demonstrates the unwavering commitment and dedication of the medical teams involved in the recovery and identification process.

In response to the urgent need for additional freezers, SKMJ Higher Secondary School in Kalpetta was immediately transformed into a central hub for the coordination and distribution of freezers. A specialized team of experts, including forensic and general surgeons, were swiftly assembled to manage the mortuary affairs with utmost care and efficiency.

As per the circular DMA2/222/2024 dated 16.08.2024 (Ref. GO (Rt) No. 572/2024/DMD dated 03.08.2024), to verify the unidentified body parts recovered from the site of the landslide, material samples were collected and sent for DNA matching to the designated Forensic Science Laboratory (FSL) in Kannur. It was essential for the formal identification of unclaimed bodies and body parts for the registration of death by the local authority and handing over to the relatives/ claimants concerned.

Mental Health

Mobilized a task force to provide mental health support to the affected individuals. The task force was composed of counselors with qualifications in MSc Psychology and MSW (Medical and Psychiatry), as well as trained volunteers, all working under the leadership of the District Mental Health Program (DMHP) team. The details about psychosocial supporting activities are mentioned in section 6 - Psychosocial wellbeing.

The Meppadi landslide affected communities were temporarily shifted to relief camps. Later the camp inmates were shifted to temporary rented houses. Proper health screenings were done for the camp inmates by medical professionals. ***Table 5-8*** shows the health data of camp inmates as per DMO report.

Particulars	Number
Total No. of Pregnant ladies in the camp	13
Cumulative No. of medical camps Conducted	241
Total No. of persons given Oseltamivir to treat/prevent influenza	16
Total No. of persons given Leptospirosis (Rat fever) prophylaxis	29
Total No. of Person with disability	13
Total No. of children need special care in camp	5
Total fever cases reported in the camp	197
Fever with a rash (suspected dengue)	2
ADD (Acute Diarrheal Disease)	20
SCD (Sickle Cell Disease)	3
TB (Tuberculosis)	1
Other Communicable Diseases	2
Total No. of skin diseases	6
NCD patients in the camp (Diabetes)	52
NCD patients in the camp (Hypertension))	87
NCD patients in the camp (Diabetes and Hypertension)	49
No. of cancer patients in the camp	3
No. of patients with chronic kidney disease (CKD)	2
Dialysis Patients in the camp	2
Patients given Palliative Care	14
People given vaccinations at camp	Infants - 5 Under five - 14 Ante Natal Women -4
Total No. of well chlorinated	120
Total No. of mobile psychiatric team visits	20
Total No. of teleconsultation	46
Total No. of mobile clinics conducted	15

Table 5-8: *Final Health Data of People in Relief Camps as on 20/08/2024*

Integrated Child Development Services

1. Activities in the camps

- Anemia screening and Nutrition counseling and intervention for beneficiaries.
- Special nutrition has been provided for the inmates of all camps with the support of NGOs, till the camps are dissolved.
- Special nutrition has been provided for inmates of all camps with the support of NGOs, till all the camps are dissolved.
- ECCE sessions have been engaged in all camps by Anganwadi workers, the activity and learning materials have been made available to all camps with the support of many agencies.
- Provided cradles for children and ensured innerwear and casuals for women and adolescent girls in camps with the agency's support.

2. Tracking Beneficiaries

- The beneficiaries in various parts of the district have started tracking and re-registering in the Poshan tracker of the respective Anganwadi's. Steps have been taken to provide all services of ICDS.

AYUSH

- Counseling facilities were established for survivors by the DMO ISM (Indian System of Medicine) with the help of the Post Graduate Department of Mental Health from the Kottakkal Ayurveda Mental Hospital.
- Ayurveda and Homeo departments have integrated Mental Health Components to all clinical services rented at camps as well as for the rescue team.
- The Homeo department conducted separate counseling services in-person and through telemedicine for people under distress.
- Treatments and medicines were ensured by the ISM department for injuries, joint trauma and pain for the suffering individuals in the camps as well as for the members of the rescue team.
- Homoeopathic Psychosocial Support Team (HPST) provided Psychological First Aid, Counseling etc.
- Supply of Homoeopathic First Aid Kits was also ensured.

5.6. Reconstruction and Recovery Needs Assessment

The State government is planning to build a resilient township which caters for 600 (short-term) to 2000 (medium to long-term) families as the reconstruction and recovery option. It may develop a community of population size 2500-3500 (short-term) and 7500-10,000 (medium to long-term). So, it is suggested that the structures and functions of health and nutrition for the estimated population that may occupy the township - one Health and Wellness Centre (HWC) for 3500-5000 people, one Anganwadi Centre (AWC) for 750-1000 people and one ration shop for 2000-3000 people. So, have to build an HWC, two AWCs and one ration shop in a short-term period of 6 months and it should be escalated to two HWCs, 5 AWCs and three ration shops in a medium-long term period.

As it is a township where a large number of people live together, along with these it is suggested, the establishment of one clinic with evening OPD with a laboratory which can perform basic blood and urine examination, an Ayurveda dispensary, one Maveli store (civil supplies outlet) and a Karunya medical shop for the entire area. One mobile Homeo clinic may also be established in the location because that service was already availed and experienced by the shifted community at Chooralmala-Mundakkai area. Services for palliative care centre and a fitness centre may also establish in each health and wellness centres.

Given the district's epidemiological profile, characterized by a high incidence of infectious diseases and non-communicable diseases, coupled with the vulnerability of the population and the township's unique characteristics, it is recommended to establish two health complexes. The first complex should include a health and wellness center, an evening clinic, a laboratory, and a gym. The second complex should include a health and wellness center, an Ayurvedic clinic,

and a palliative care center.

To address the long-term mental health needs of the affected community and the district as a whole, the establishment of a specialized mental health facility is imperative. This facility can provide comprehensive mental health services, including treatment for post-traumatic stress disorder (PTSD) and other mental health conditions. Furthermore, this facility can serve as a resource for the district in the event of future emergencies. It is important to note that currently, there are no tertiary-level mental health facilities within the district.

As the district is vulnerable for disasters of similar kind in future, it is very important to strengthen the emergency and trauma care facility of Government Medical College, Mananthavady. The facility at the medical college is rudimentary and the affected people have to depend on facilities in Kozhikode. As the district is prone for major natural disasters and human-animal conflicts, setting up a state of art emergency care and trauma care facility at the medical college is the need of the hour.

It is critical to add another two components in the recovery part. One is the training and capacity building of the health personnel's and local community on Hospital Safety/departmental DM plan. Second is a research study on zoonotic diseases focusing on human-wild life conflicts and high threat diseases like KFD and Nipah. A detailed proposal of health and nutrition facilities for the township are shown in ***Table 5-9***.

Mainstreaming Hospital safety

The National Hospital safety guidelines formulated as a requisite of the Disaster Management act 2005, envision that all health institutions in the country will be structurally and functionally safer from disasters, such that the risks to

Facility	Short-term	Medium term (Incremental)	Long term (Incremental)	Total
Health and Wellness Centre	1	1	0	2
Anganwadi	2	2	1	5
Evening Clinic	1	0	0	1
Laboratory	1	0	0	1
Ayurveda Clinic	1	0	0	1
Mobile Homeo Clinic	1	0	0	1
Fitness Centre	1	0	0	1
Karunya Medical Shop	1	0	0	1
Palliative Care Centre	1	0	0	1
Ration shops	1	1	1	3
Maveli store	1	0	0	1
Tertiary mental health centre at Kalpetta	1	0	0	1
State of art emergency and trauma care facility at Government Medical College, Mananthavady	1	0	0	1

Table 5-9: *Health and Nutrition Related Facilities Proposed for the Township*

human life and infrastructure are minimized. The overall aim of the guidelines is to mainstream disaster prevention, mitigation, preparedness and response activities into the health sector in our country, with specific focus on hospitals; such that hospitals are not just better prepared but fully functional immediately after disasters and are able to respond without any delay to the medical requirements of the affected community.

Hazard assessment, preparedness measures and formulation of hospital DM/safety plan ensures the initiation of hospital safety activities. The plan should include the functional continuity of the health facilities in the wake of an emergency. The surge of outpatient in the context of a disaster and an alternate plan to accommodate and address the needs also to be planned and executed.

Thus, the hospital safety plan ensures the following:

a. preparedness of the health facility to respond and recover from internal and external emergencies

b. continuity of essential activities, critical services and safety of its hospital staff, patients, visitors, and the community

c. coordinate and organize response to various incidents including protection of the facility and hospital services.

KSDMA had initiated several programmes in the past related to hospital safety and associated with Kerala State Institute of Health and Family Welfare in integration of hospital safety awareness sessions in several induction programmes related to health professional in the Government sector. KSDMA in association with UNDP and GHS had also conducted various training sessions in all District hospitals on Kerala and drafted the institutional DM plans. The need to expand such programmes to the local level health institutions such as PHCs, CHCs, Taluk hospitals and other private institutions especially in the high hazard – Multi hazard zones across Kerala is the need of the hour. There should be an integration of these safety plans as part of the local level DM plans and local development plans. This will ensure alternate networking of the health institutions in the post disaster scenario. Currently, this kind of networking is mostly decided and executed as part of the post – disaster activity as in the case of the Chooralmala disaster. Preparing and planning for the surge of health services can be done as part of the hospital safety plan which will ease the activities and reduce the response time.The costs of additional human resources, recurring material consumption and maintenance costs should be supported for 5 years. To address the long term mental health need of the community affected by the disaster, and that of the district, a tertiary mental health centre at Kalpetta.

Reconstruction Cost Estimates

Increased risks must be addressed, and efforts should be actively made to minimize interruptions in the treatment of chronic illnesses. Investing in disaster risk reduction and disaster risk management capacities is essential, along with adopting the "Build Back Better" (BBB) approach for infrastructure and services. Early recovery priorities include restoring the functionality of the health system and building capacity for effective service delivery. While restoring health functions in disaster affected areas, opportunities to build back better should be embraced. This includes reconstructing or renovating health infrastructure to be more resilient to future disasters, improving access to health services beyond pre-disaster levels, strengthening disaster risk management capacities of governments and communities, and reducing risks and vulnerabilities to future disasters.

As the population is displaced and the Government is not planning to inhabit the area because of potential high risk to environmental hazards and disasters, are not recommend any reconstructions in the affected area. But the health facilities and Anganawadi's can be construct in the new township.

A detailed estimate of reconstruction cost is included in ***Table 5-10***.

Recovery Strategy and Recovery Cost Estimates - Build Back Better

The recovery process should focus on strengthening the provision of basic health services, with particular attention to gender and vulnerable groups. Given the ongoing risks arising from

Table 5-10: *Reconstruction Cost Estimates*

Township- Reconstruction Cost Estimate (In Crore) – Health and Nutrition facilities							
Sl. No.	**Category**	**Reconstruction and Recovery Measures**	**Numbers**	**Unit Cost for structures (in crores)**	**Cost Estimate (in crores)**	**Total Cost (in crores)**	**Timelines**
1	Health Care	Integrated Health and Wellness Centre Complex (2000 SFT)	2	INR. 0.55	INR. 1.10	INR. 1.1	Short term -1, medium term -1
2	Health Care	Strengthening the emergency and trauma care facility of Government Medical College, Manan-thavadi	1	INR. 25		INR. 25	Short term-1
3	Health Care	Tertiary mental health centre (infrastructure) -Kalpetta	1	INR . 5		INR. 5	Short term -1
4	Nutrition	ICDS (1200 SFT) - A creche facility and old age recreation facility with the concept of 'Pakalveedu'	5	INR 0.50	2.50	INR. 2.5	Short term -2, medium term -2, long term -1
		Total Reconstruction Needs Estimate				**33.6 Cr**	

the disaster's impact, support to health services should focus on:

a. Addressing the injuries and medical emergencies
b. Addressing the mental health needs
c. Epidemiological surveillance of the population
d. Infectious disease prevention and control, including adequate supplies and mobile response capacity; and
e. Health promotion through community outreach, particularly among vulnerable groups, with an emphasis on the prevention and treatment of vector- and waterborne diseases.

To ensure a coordinated approach to the provision of health services, coordination mechanisms will be established within the health system in Wayanad. These mechanisms will facilitate agreement among health sector partners on key expected outcomes and ensure that resources from various institutions are allocated efficiently. Additionally, risk insurance should be provided for public health facilities and pharmaceutical supplies to safeguard against future uncertainties. The recovery cost details are given in ***Table 5-11***.

5.7. Impact/ Outcome of Recovery

Table 5-11: *Recovery Cost Estimates (in crore)*

Training and Capacity Building							
Sl. No.	**Category**	**Recovery Measures**	**units * years**	**Unit Cost**	**Cost Estimate**	**Total Cost (in crores)**	
HEALTH							
1	Training and capacity building on Hospital Safety/departmental DM plan	building capacity among the people inside and outside of the township and public health personnel's	1* 5 Year	1 Cr. per year	5 Cr.	5 Cr.	
2	Research	Research study on zoonotic diseases	for 5 years		2 Cr.	2Cr.	
Service continuity and material procurements							
3	Strengthening the emergency and trauma care facility of Government Medical College, Mananthavady	Recurring/scaling up cost of 5 crores per year	1* 5 year	5 Cr.	25 Cr.	25 Cr.	
4	Tertiary Mental health Centre at Kalpetta	HR, Equipment's, recurring service	5 years	0.5 Cr.	2.5 Cr.	2.5 Cr.	
5	HWC (1 short term and 1 medium term)	30L for other infrastructures	2 units	0.3 Cr.	0.6 Cr.	0.9 Cr.	
		Recurring cost -HWC complex 1st	1*4 year	0.05 Cr.	0.2 Cr.		
		Recurring cost - HWC complex 2nd	1*2 year	0.05 Cr.	0.1 Cr.		

6	Evening Clinic	HR cost (on call doctor and a nurse) INR 19L per year Medicines- INR 10L per year	1* 5 Year	0.29 Cr.	1.45 Cr.	1.45 Cr.
7	Laboratory	Lab equipment's & reagents (10L per year) and HR (10L per year)	1* 5 Year	0.20 Cr.	1.00Cr.	1 Cr.
8	Ayurvedic dispensary	HR & service (19L per year) medicines (10L per year)	1* 5 Year	0.29 Cr.	1.45 Cr.	1.45 Cr.
9	Mobile Homeo Clinic	Consultation, Recurring costs (5L per year) medicines (5L per year)	1* 5 Year	0.10 Cr.	0.50 Cr.	0.5 Cr.
10	Fitness Centre	HR& service, Installation cost (10L)	1 unit	0.10 Cr.	0.10 Cr.	.14 Cr.
			1*4 year	0.01 Cr.	0.04 Cr.	
11	Palliative care centre	HR & Service -2.46 Lakhs per year material costs 5 Lakhs per year	1* 5 Year	7.46 Lakhs	373 Lakhs	.373 Cr.
12	Karunya medical shop	Cost of Medicines 10L per year	1* 5 Year	0.1 Cr.	0.50 Cr.	0.5 Cr.
13	Food and civil supplies (Ration shop)	Short term -1	1* 5 year	0.15 Cr.	0.75 Cr.	1.35 Cr.
		Medium term-1	1* 3 years	0.15 Cr.	0.45 Cr.	
		Long term -1	1*1 year	0.15 Cr.	0.15 Cr.	
14	Maveli Store	Materials	1* 5 Year	0.15 Cr.	0.75 Cr.	1.05 Cr.
		Anticipated population growth cause need of more materials in long term		0.30 Cr.	0.30 Cr.	
		Total Recovery Needs Estimate				**43.213 Cr.**

Disaster Risk Reduction- Cross-cutting

- *There should be a disaster management plan for the township to safeguard it from fire, flood and other disasters which can affect human lives and health. Disaster management plans should include health facility planning with standard operating procedures. Action oriented district disaster management plans with response roles to health and allied sectors depending on type of disaster should be drawn up.*
- *The township should be located in areas where there are limited chances of human-animal conflicts.*
- *The township should be protected using fences to avoid entry of wild animals as far as possible to avoid zoonotic diseases like KFD.*
- *No bat roosts should be destroyed to build the dwelling places because of the threat of Nipah.*
- *Solid waste management system should consider the chances of Dengue and other mosquito borne diseases that can spread in the township.*
- *There should be a dedicated system that can filtrate and chlorinate water used for drinking as Wayanad is endemic for many waterborne diseases including Cholera.*
- *All possible chances of sewage waste come in contact with water sources, streams, pipe water supplies and underground water should be avoided.*
- *The township should be well connected to family health centre, public and private hospitals nearby.*
- *The Government Medical College, Mananthavady and other specialty hospitals of the district should be strengthened considering the vulnerability of the district for health related disasters.*
- *The building of new hospitals in all tiers to make the district self reliant in the health care of people including tribes.*
- *There should be a special focus to the NCDs and palliative care services for the inhabitants of the township.*
- *Because of the high risk of mental disorders like post-traumatic stress disorders, there should be a continuous system to deliver mental health services to the community.*
- *There should be protocols to manage pregnant and lactating mothers— particularly mothers nearing expected delivery date and those with high risk pregnancies.*
- *There should be a system to support tribal districts. Most of the tribal hamlets are remote and difficult to reach.*
- *Information to the tribal communities should be translated to languages they can understand and communicate in. The IEC materials, as well as communication methods, should be designed according to their needs.*
- *There should be a coordination mechanism between ICDS, Health Department, Scheduled Tribes Development Department, and LSGs at the district level for improving health and nutrition of the tribal population.*
- *Safety of health infrastructure should be assessed with regard to various kinds of disasters and appropriate investments made for disaster resistant infrastructure.*
- *Epidemiological studies and investments for vector control measures, including introduction of technology for monitoring and prompt reporting will help.*

06



Psychosocial Wellbeing

6.1. Background of the Sector

The term “psychosocial” underscores the intricate interplay between an individual’s psychological state and their social context. Psychosocial support is indispensable for preserving both physical and mental well-being, serving as a vital coping mechanism during challenging times.

Such interventions form the cornerstone of Mental Health and Psychosocial Services (MHPSS), encompassing a spectrum of psychological and social activities aimed at fostering psychological improvement. These activities may include shared experiences, social support networks, awareness raising initiatives, and psychoeducation.

Disasters can have profound repercussions beyond physical destruction, significantly impacting the mental health and psychosocial well being of affected communities. The traumatic experiences of disasters can lead to psychological distress, social isolation, and diminished resilience.

The World Health Organization (WHO) has noted that a disaster syndrome may manifest in a substantial portion of those affected, ranging from 25% to 75%. This syndrome is characterized by a specific behavioural pattern marked by stunned, dazed, and seemingly disengaged behaviour.

To mitigate these challenges, psychosocial interventions are paramount in disaster response and recovery efforts.

NOTE: Out of respect for the sensitive nature of the section, the inclusion of images related to the affected communities has been intentionally omitted.

By providing support, promoting coping mechanisms, and strengthening community bonds, these interventions can facilitate individual and community healing, recovery, and rebuilding following a disaster, ultimately reducing the risk of longlasting psychological and social harm. Post-disaster mental health concerns encompass depression, anxiety, and a range of other issues, including post-traumatic stress disorders.

6.2. Mental Health and Psychosocial Support Framework [2]

India's recurrent experience with disasters, both large and small, underscores the profound impact on not only physical and economic well-being but also mental health and psychosocial well-being. Recognizing the critical nexus between mental health and disaster risk reduction, there has been a proactive shift towards planning and implementing Mental Health and Psychosocial Support (MHPSS) activities within disaster response frameworks.

In response, the National Disaster Management Authority (NDMA) has taken significant steps to enhance MHPSS integration in disaster management. The 2009 "National Disaster Management Guidelines: Psychosocial Support and Mental Health Services in Disasters" were updated, and in 2023, NDMA, in collaboration with NIMHANS, released the "National Disaster Management Training Module-1 for Psychosocial First Aid." Moreover, updated MHPSS guidelines, developed in conjunction with Rahbar, a field action project of TISS, were published.

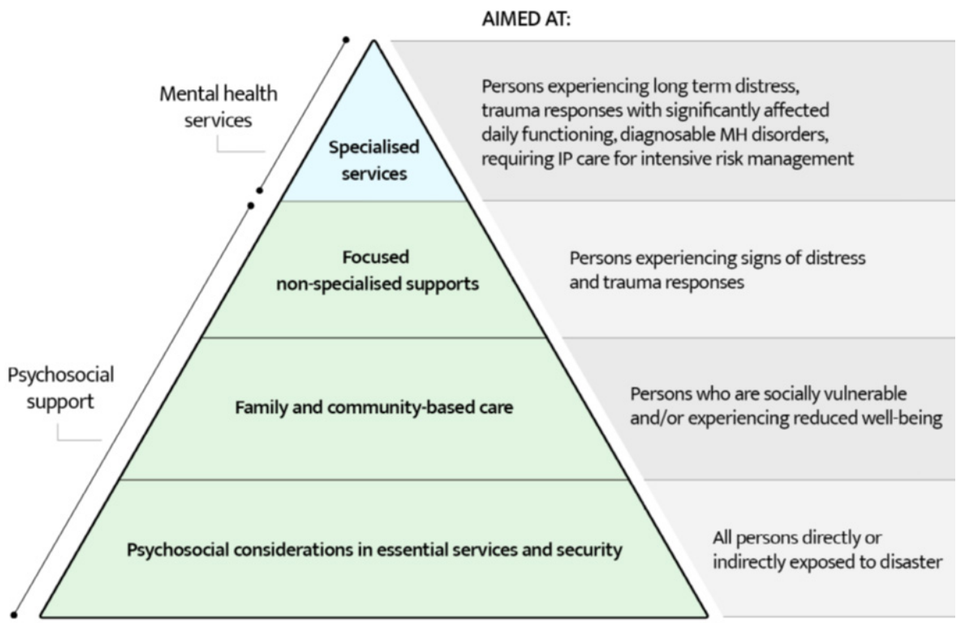


Figure 6-1: *MHPSS Pyramid for Disasters*

[2] *National Disaster Management Authority and Rahbar (2023). National Disaster Management Guidelines Mental Health and Psychosocial Support Services in Disasters.*

National Disaster Management Training Module-1, Psychosocial First Aid.

These updates aim to provide clear guidance for all phases of disaster management, encompassing preparedness, mitigation, response, recovery, rehabilitation, and reconstruction. The guidelines offer updated information on effective MHPSS activities, ensuring alignment with contemporary national and international best practices. Importantly, they extend the scope of MHPSS beyond traditional clinical services, emphasizing a community centric approach to supporting the mental health and well being of those affected by disasters.

A Multi-Tiered Approach to Psychosocial Support in Disasters [3]

In the aftermath of a disaster, it can be challenging to differentiate between individuals experiencing transient emotional distress and those developing mental disorders requiring specialized care. However, over time, it is imperative to implement processes that accurately identify and direct individuals to appropriate support based on their current mental health status.

This care should extend not only to those necessitating long-term or intensive mental health interventions but also to those experiencing short-term emotional distress and trauma responses, as well as those vulnerable due to disaster exposure or social circumstances, even if they do not exhibit overt signs of distress or trauma. Consequently, well-organized and adaptable MHPSS services, capable of scaling up or down according to community needs, are indispensable.

Level 1: Psychosocial Considerations in Essential Services and Security

Forms the foundation of the pyramid. It advocates for and documents the provision of basic services and safety measures in a manner that is psychosocially sensitive, trauma informed, culturally appropriate, and designed to protect the rights and dignity of individuals. This level is intended for all persons directly or indirectly exposed to the disaster.

Level 2: Family and Community-Based Care

Encompasses the foundational support provided to individuals by reestablishing family and community support networks that may have been disrupted by the disaster. This level is targeted toward all individuals at risk of developing psychosocial and mental health concerns due to various forms of disaster exposure, such as bereavement, as well as those who are socially vulnerable.

Services at this level include establishing support through assisted mourning and community healing practices, reactivating social networks and supports, and ensuring appropriate access to information and resources to cope with distress.

Level 3: Focused, Non-Specialized Services

Involves providing focused psychosocial care and support interventions, including psychosocial first aid. This level is intended for individuals experiencing mild distress and trauma responses and is delivered by trained non-specialists.

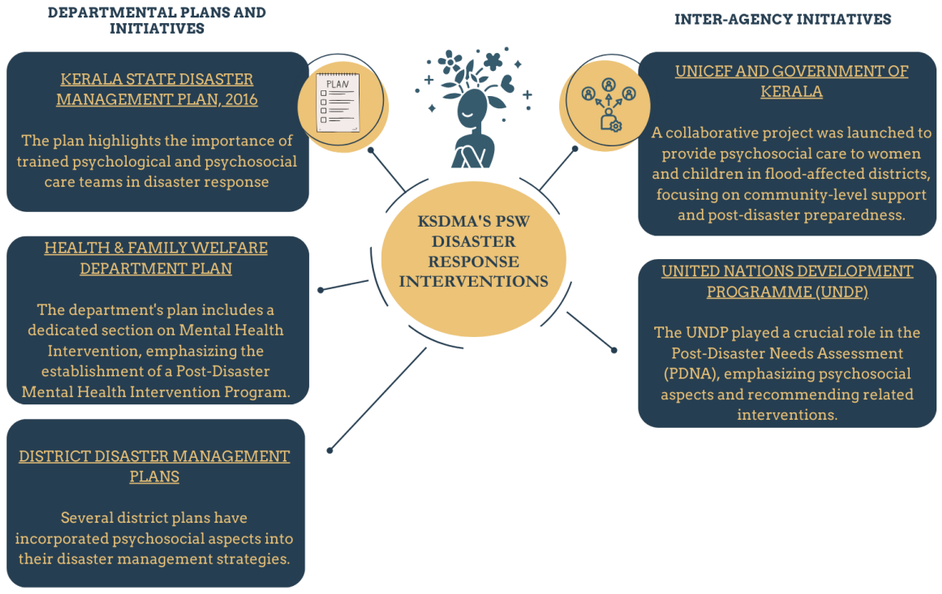
Level 4: Specialized Services

Some individuals may experience moderate or severe distress, pose a risk of harm to themselves or others, or exhibit significant impairment in daily functioning or longstanding mental health distress or trauma leading to mental disorders. These individuals may require more intensive and frequent interventions than that available at previous levels.

Services at this level include a wide array of counseling, psychotherapy, and pharmacological interventions, such as cognitive behavioural therapy, rational emotive behavioural therapy, interpersonal therapy, narrative therapy, psychotropic medication, and inpatient services.

[3] *National Disaster Management Authority and Rahbar (2023). National Disaster Management Guidelines Mental Health and Psychosocial Support Services in Disasters, pp. 34-35.*

Figure 6-2: *State Response to Psycho Social Wellbeing – The interventions*



6.3. Psycho-Social Wellbeing (PSW) Interventions in Kerala Disaster Response

The Kerala State Disaster Management Plan of 2016 emphasizes the indispensable importance of training in psychosocial care, acknowledging its significant role in addressing the mental health and wellbeing of disaster affected communities.

This section provides a concise overview of the implementation of psychosocial interventions in Kerala, drawing from various departmental plans and initiatives undertaken in response to major disasters that can be adopted as a model in psychosocial wellbeing.

Multi-Departmental Approach for Disaster centric PSW in Kerala – Learnings from the Past

A multi-departmental approach is indispensable in disaster management, particularly when addressing the complex psychosocial needs of affected populations. In India, psychosocial care interventions are effectively implemented through collaborative efforts between various governmental and non-governmental entities, fostering a comprehensive response.

In Kerala, past disasters have emphasised the importance of integrating services across multiple sectors to support psychosocial wellbeing, where the state has initiated coordinated responses involving key programs and agencies such as the DMHP, ICDS school counselors, nurses from the RBSK under the NHM. Additionally, DISHA counsellors, JHI, JPHN, ASHA, and Anganwadi workers have played decisive roles in delivering psychosocial care.

This multi-sectoral effort is further strengthened by the involvement of the WCD department, the NIMHANS, and IAGs, ensuring a community centered and comprehensive approach to mental health care in disaster contexts.

The implementation and evaluation of these psychosocial interventions are underpinned by a rigorous collection and analysis of data from these agencies, enabling targeted, evidence based strategies. This data driven approach facilitates the development of effective inter-

Figure 6-3: *Multi-departmental interventions for Psychosocial Care in Kerala Disasters – A look Back*



vention methods tailored to the specific needs of the affected populations. Joint efforts are spearheaded by several key governmental bodies, including the Departments of Health, Revenue & Disaster Management, Social Justice, Fisheries, Local Self-Government Department (LSGD), Education and other concerned departments. Each department plays a paramount role in addressing the specific needs of disaster affected communities, leveraging its expertise to deliver customized psychosocial support.

Over time, Kerala has systematically implemented extensive psychosocial care interventions in response to major disaster events. These interventions address both immediate mental health needs and long-term psychosocial recovery, ensuring a holistic care framework. The coordinated efforts help enhance the resilience of communities, empowering them to recover more effectively from the psychological impacts of disasters.

6.4. Pre - Disaster Phase

Mental Health Services in Wayanad District and Meppadi

In Wayanad district, the prevalence of psychiatric medications among the population has remained relatively stable over the past three months. As of July 2024, there were 2,264 individuals receiving psychiatric medications. Within the tribal communities, 450 individuals were under medication during the same period. Currently, Wayanad district is served by five psychiatrists practicing modern medicine, attending to a population of approximately 870,420. Additionally, there are 21 professional social

workers on contract basis engaged in various programs such as RKSK, NTCP, KSACS, and ICTC. However, a dedicated psychologist position remains unfilled in the district.On average, 66 individuals attend the District Mental Health Program (DMHP) camp at CHC Meppadi. The last mental health camp held in Meppadi prior to the disaster took place on July 19, 2024, with 66 patients seeking assistance.

The state government, through the DMHP, has been actively implementing various Mental Health and Psychosocial initiatives across different regions of Wayanad district. The DMHP team, comprising multidisciplinary mental healthcare professionals, has been conducting mental health awareness camps and outreach programs through the CHCs in the communities.

The Meppadi Grama Panchayat area is one of the regions benefiting from these initiatives. Every third Friday of the month, a mental health camp is held at CHC Meppadi to address the mental health needs of the local population.The existing projects under DMHP are as follows:

Mental Health Camps by DMHP

The DMHP Wayanad team is actively organizing and conducting community based psychiatry camps across various regions of Wayanad district. Each month, a total of twenty one camps are being held in eighteen selected areas within the district.

The interdisciplinary team leading these camps comprises a psychiatrist, medical officer, clinical psychologist, psychiatric social worker, staff nurse, and an attendant. This diverse team composition ensures a comprehensive approach to addressing the mental health needs of the local population.

SMA (Sampoorna Manasikaarogyam / mental health for everyone)

The SMA initiative seeks to seamlessly integrate mental health services into primary healthcare. The DMHP team is actively providing training in mental health skills to medical officers at FHCs and ASHA workers throughout the district. Currently, SMA camps are being conducted at twenty four FHCs in Wayanad district. These camps serve as platforms for providing mental health services and raising awareness within the community.

School Mental Health Project

The school mental health project is a comprehensive initiative designed to cultivate a supportive learning environment for students by prioritizing and enhancing the mental health and psychosocial wellbeing of students, teachers, and parents within the educational setting.

Key components of the project include mental health screening and assessment, individual and group counseling services, referrals to specialized care, and classroom based mental health education. These activities collectively contribute to reducing stigma surrounding mental health within the educational context of Wayanad district.This project is implemented on a monthly basis, providing ongoing support and services to the school community.

Aashwasam

The DMHP team is actively conducting training sessions to equip field staff, including ASHA workers, JHI, JPHN, staff nurses, and medical officers, with the skills necessary for the early detection and management of depression. Currently, twenty four FHCs in Wayanad district are participating in the Aashwasam project, a comprehensive initiative aimed at addressing mental health needs within the community.

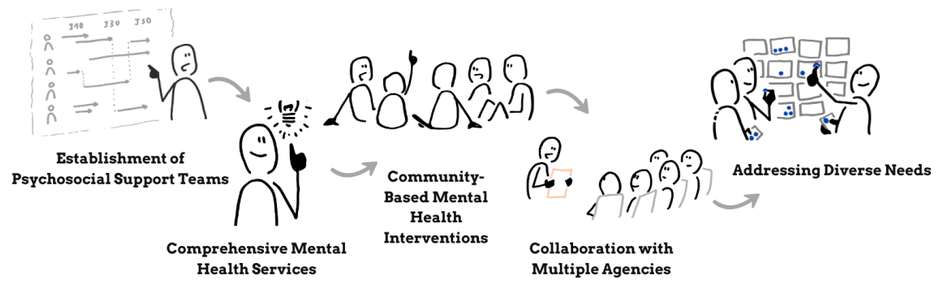
Tribal Mental Health Project

The Tribal Mental Health Project is a targeted initiative designed to address the specific mental health needs of tribal communities. By conducting psychiatric camps within their own living areas or colonies, the project aims to enhance accessibility and reduce barriers to care.

Cases are initially identified and subsequently referred to the nearest DMHP camps for ongoing follow-up. Additionally, the project implements several awareness sessions to mitigate stigma surrounding mental health issues and promote knowledge about available treatment facilities. This comprehensive approach seeks to improve mental health outcomes and wellbeing within tribal communities.

6.5. Government Response

Figure 6-4: *The Process in Psycho Social Wellbeing Response*



In the aftermath of the Chooralmala disaster, the district administration implemented a coordinated response by appointing nodal officers from various departments to facilitate effective collaboration between government agencies and local communities, as outlined in Order No: DCWYD/2864/2024-DM3, dated August 1, 2024 [order attached in 1.1 Annexure 1].

A key component of this coordinated response was the provision of counseling sevanam/ services, overseen by the District Social Justice Officer who served as the nodal officer for psychosocial support. This team comprised representatives from WCD, DHS, NHM, and CWC [Central Water Commission]. The need based service delivery was monitored and implemented by the DMHP, in collaboration with other specialized professionals possessing expertise in mental health and psychosocial care, thereby providing holistic support to those impacted by the disaster. The primary objective of this group was to ensure the delivery of comprehensive psychosocial support through counseling, addressing the psychological consequences of the disaster, including PTSD, among the affected population.

The process of response and significant interventions in psychosocial wellbeing is summarized in ***Figure 6-4*** with reference to the same, the detailed actions taken are further elaborated.

In response to the mental health crisis triggered by the Meppadi landslide, the government swiftly deployed a team of mental health professionals from the District Mental Health Program (DMHP) to the Meppadi Community Health Centre (CHC) on July 30, 2024. This team promptly visited the first relief camp established at Meppadi GHSS on the day of the landslide.

A dedicated psychosocial support task force was formed, comprising psychiatrists and qualified counselors from the District Mental Health Program, National Health Mission, Institute of Mental Health and Neurosciences (IMHANS), Domestic Conflict Resolution Centre (DCRC), and Department of Women and Child Development (WCD). Following training in mental health and psychosocial interventions for disaster management, these team members were deployed to all subsequent relief camps.

Over time, the task force expanded to include counselors from other departments such as LSGD/Kudumbashree, Police, and Social Justice Department, along with volunteers from Wayanad and other districts of Kerala, including NGOs, IAGs, District IAG GO-NGO, and individuals. The primary objective was

to provide reassurance, support, and identify individuals in distress within the relief camps. Counselors were available round the clock in the relief camps, and those requiring advanced support or interventions were referred to specialized services. To enhance accessibility, a 24-hour mobile psychiatry unit was initiated on August 6, 2024, enabling specialized services within the camps and home visits as needed.

Teleconsultation facilities were established using two toll-free numbers (1800 2331533, 1800 2335 588) and the telemanas toll-free number (14416), providing 24-hour on-call counseling services. The DMHP team also extended their support to the rescuers and first responders at the landslide site in Chooralmala. The team engaged with these individuals, assessed their emotional wellbeing, and offered guidance on stress management and coping mechanisms.

In addition to these efforts, Ayurveda and Homeopathy mental health services were made available in the relief camps, providing a comprehensive approach to addressing the diverse mental health needs of the affected population.

Vulnerable populations, including minors, the elderly, pregnant and lactating women, individuals with a history of mental illnesses, those with substance abuse issues, and migrant workers, were identified as requiring special attention. Consistent follow-up screening and support were ensured by maintaining the same set of counselors to interact with these individuals, fostering rapport and enabling ongoing monitoring of progress.

To enhance the effectiveness of psychosocial interventions, counselors received continuous training sessions, and daily data reporting to higher authorities was implemented. This facilitated proper evaluation and monitoring of the ground-level activities.

Trauma screening was initiated among a select group of first responders to identify potential cases of Post-Traumatic Stress Disorder (PTSD). This proactive measure aimed to address the mental health needs of those directly involved in the disaster response efforts.

6.6. KUTTIYIDAM - Child friendly space in relief camps

Children are disproportionately impacted by disasters and emergencies, necessitating specialized efforts to address their mental trauma.

The District Child Protection Unit (DCPU) of the Department of Women and Child Development, Government of Kerala, recognized the critical importance of establishing child-friendly spaces within relief camps to assist children in coping with the psychological distress and trauma associated with disasters.

"Kuttiyidam," which translates to "a space for children" in Malayalam, was launched on August 1, 2024, in 15 relief camps across the state. These spaces were designed to engage children through games, arts, and other activities, providing a safe and supportive environment for healing and recovery. The primary objective of Kuttiyidam was to aid affected children in overcoming the trauma related to the disaster.

A trained counselor, along with volunteers, was present in each space to facilitate activities and engage with the children. This marked the first-ever implementation of Kuttiyidam initiatives in relief camps within the state.

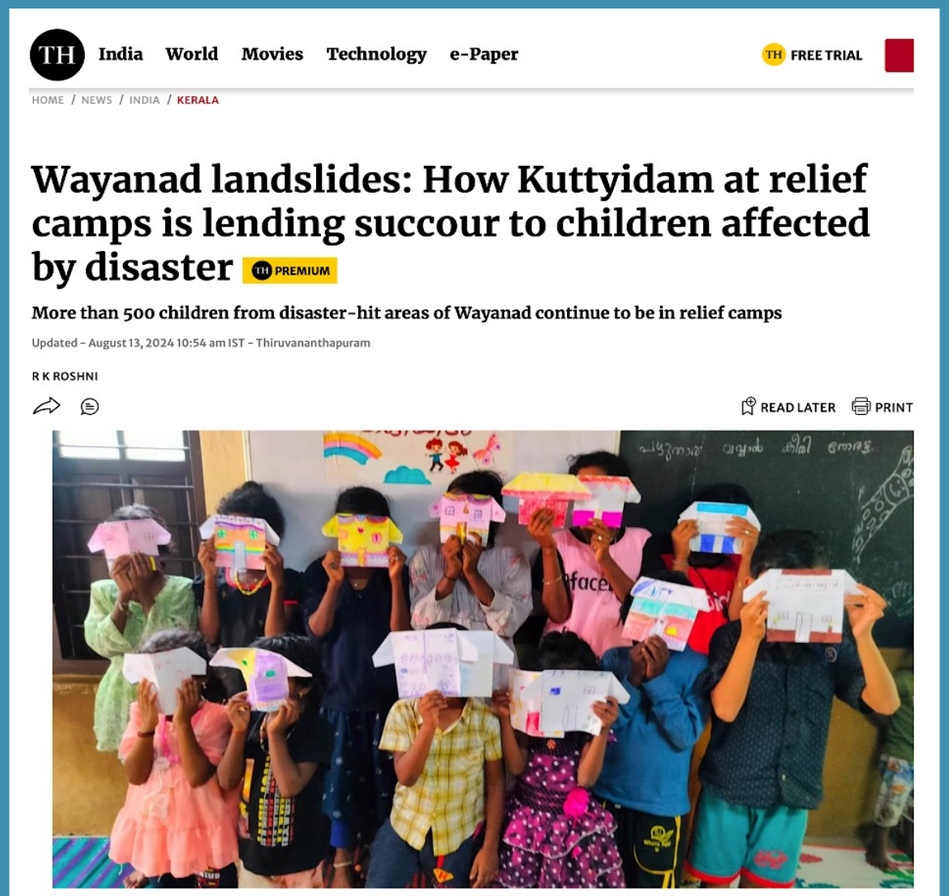
To address the mental stress and trauma experienced by children, specially curated activities were conducted in coordination with other departments and organizations. A total of 140 programs were successfully implemented at Kuttiyidam spaces, with the support of various agencies.

These activities encompassed a diverse range of engaging experiences, including bubble art, folk songs, painting competitions, magic shows, and art-based programs.

In collaboration with UNICEF, the Department of Women and Child Development (WCD) orga-

Sl.No	Interventions	Total
1	Psychosocial sessions in the relief camps (Psychological first aid and counseling sessions / therapies)	7510
2	Group sessions	269
3	Participants in group sessions	4552
4	Pharmacotherapy services (new + follow ups - (61 + 151)	212
5	Total number of home visits (Mobile psychiatry unit)	202
6	Tele consultation	137
7	Psycho social support provided at the households after the relief camps were closed	1044
8	Total number of professional counselors available in the field	72
[Source - DMHP, Wayanad]		

Table 6-1 *Overview of Mental Health and Psychosocial Services provided [As On 30/8/24]*



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Wayanad landslides: How Kuttyidam at relief camps is lending succour to children affected by disaster PREMIUM

More than 500 children from disaster-hit areas of Wayanad continue to be in relief camps

Updated - August 13, 2024 10:54 am IST - Thiruvananthapuram

R K ROSHNI

READ LATER PRINT

Children engage in activities at a Kuttyidam set up at RC Lower Primary School, Chundel, Wayanad, Kerala. | Photo Credit: Special Arrangement

Figure 6-5: *News featured about Kuttyidam in The Hindu*

Figure 6-6: *Kuttiyidam of Meppadi Relief Camp*



"Kuttiyidom is a beacon of hope for these children, who have been through so much. By providing a safe space for them to play, learn, and express themselves, we believe they will emerge stronger and more resilient than ever."

About child friendly space in Meppadi school relief camp, Chooralmala, Meppadi landslide 2024

The quote encapsulates the essence of the child-friendly space established within the Meppadi School relief camp during the Chooralmala landslide in Wayanad, 2024. This initiative serves as a prime example of the broader effort undertaken by the Kerala State Disaster Management Authority (KSDMA) and UNICEF to promote child-friendly spaces within Multi-Purpose Cyclone Shelters (MPCS) across the state. KSDMA is working on formulating a guideline for Child Friendly Space for ensuring safe, nurturing environment where children can recover from the emotional and psychological trauma inflicted by disaster. The Meppadi School relief camp serves as a model for implementing these principles, demonstrating how child-friendly spaces can play a vital role in supporting the well-being of children during disasters.

[Source: KSDMA]

nized an orientation program on art-based counseling on August 8, 2024. This initiative aimed to equip counselors with the necessary skills to effectively engage with children residing in the relief camps. Recognizing the positive impact of Kuttiyidam, the department has decided to extend similar initiatives to schools when they reopen, ensuring a seamless transition and continued support for children's mental well-being.

The provided table [***Table 6-1***] outlines the various initiatives undertaken by government departments to ensure the delivery of mental health and psychosocial services to the affected population. A total of 72 qualified counselors were deployed to the field to provide direct support. Additionally, 137 teleconsultation services were offered, expanding the reach of mental health care.

The mobile psychiatry unit played a crucial role in extending services directly to individuals within their homes, reaching 202 cases. Group therapies were conducted to address the trauma experienced by the affected population, with 4,552 individuals participating. To ensure ongoing support, counselors conducted regular follow-up visits to severely affected families, particularly those experiencing bereavement and loss. Even after the closure of relief camps, counselors were assigned to conduct home visits to continue providing essential MHPSS services.

Following the initial phase of providing psychological first aid, a needs assessment was conducted using a standardized proforma (see annexure) developed by the state government.

This assessment facilitated a more targeted and effective approach to addressing the specific mental health needs of the affected population.

6.7. Impact on Mental Health

Disasters can have a profound and unequal impact on the mental and psychosocial wellbeing of individuals and communities. Collective trauma, a shared psychological response to a traumatic event affecting an entire society, often arises in such situations.

This collective trauma is not merely a historical fact but a deeply ingrained memory that shapes the group's identity and understanding of the event. It involves a continuous reconstruction of the trauma to make sense of it, going beyond a simple reproduction of the events.

Communities and families experiencing collective trauma tend to exhibit passivity, mistrust,

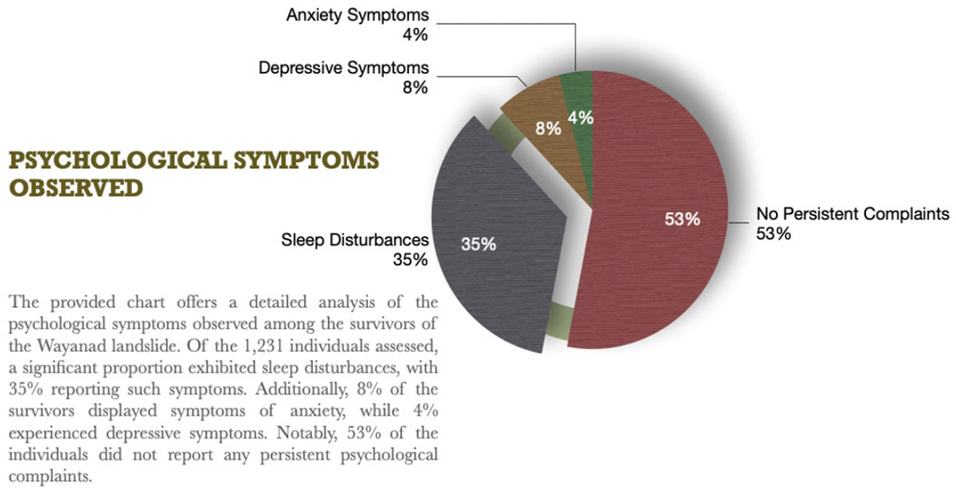
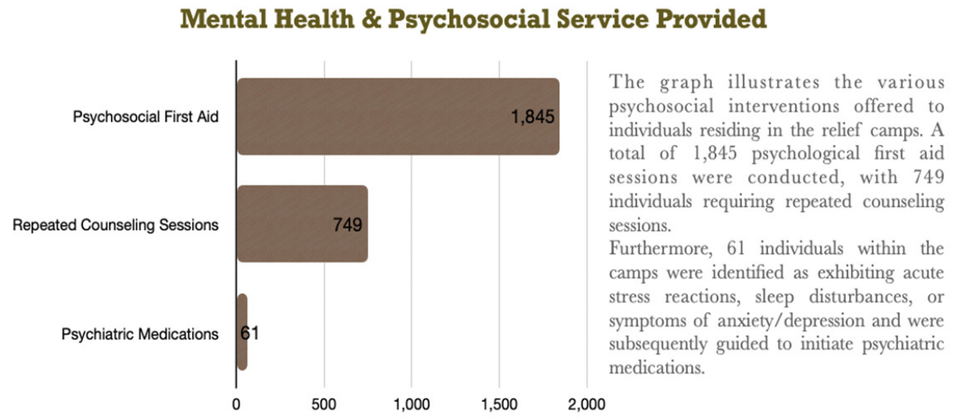


Figure 6-7: *Impact of Mental Health on the affected community - The Symptoms*

Figure 6-8: *Impact of Mental Health on the affected community - Service provided*



silence, dependence, and a lack of leadership. The landslide that occurred on July 30, 2024, in Wayanad had a devastating impact on the mental health of the local population. Many individuals who narrowly escaped the disaster experienced significant psychological distress, which may continue to affect their daily lives.

6.8. Recovery Plan

Building upon the Mental Health and Psychosocial Support (MHPSS) framework outlined in the NDMA guidelines, a comprehensive recovery plan is being drafted for Wayanad. This plan incorporates short, medium, and long-term interventions, recognizing the intangible nature of mental health and the unique coping mechanisms individuals employ in the aftermath of a disaster.

Acknowledging the potential long-term impact, the plan proposes a timeframe of up to five years.

While existing service centers have not sustained physical damage, long-term considerations necessitate the establishment of a dedicated Mental Health Centre (MHC) at the district level. Currently, the state has a limited network with only three government run MHCs located in Thiruvananthapuram, Thrissur, and Kozhikode.
Considering Wayanad's geographical remoteness and vulnerability to extreme weather events, a fully equipped MHC is deemed critical to ensure continued and accessible mental health services. The proposed plan outlines construction and operational costs within the health sector budget.

The following are for the recovery and rebuilding interventions:

Table 6-2 *Recovery & Rebuilding Estimates*

SI. No	Suggested interventions	Components	Unit cost (per Year)	Dura-tions (Year)	Total= Unit x Duration	Total Cost (Cr.)
1	Mobile Psychiatry Unit for grief & bereavement, suicide prevention counseling for the relatives who are surviving- follow up of psy-chosocial care services to every individual (Ward 10,11,12 - 4800 people) affected by landslides - additional support to District Mental Health team	Human resources	1500000	1	1500000	0.15
		Vehicle Operation and Maintenance Costs	2446000	1	2446000	0.2446
		Service Provider Resources and Equipment's	500000	1	500000	0.05
		Training of the service providers	500000	1	500000	0.05
		Outreach, Awareness Campaign, and Psychoedu-cation Materials	300000	1	300000	0.03
		Total	**5246000**	**1**	**5246000**	**0.5246**
1.1	Follow up by support teams (Psychosocial care)	Human resources	800000	5	4000000	0.4
		Service Delivery and Program Activities	400000	5	2000000	0.2
		Training & Capacity Building of the team	100000	5	500000	0.05
		Total	**1300000**	**5**	**6500000**	**0.65**
2	Mental Health Clinic (Manas) in Meppadi	Human resources	700000	1	700000	0.07
		Medical Supplies and Diagnostic Resources	500000	1	500000	0.05
		Infrastructures and general management cost	125000	1	125000	0.0125
		Outreach and Training Programs	50000	1	50000	0.005
		Service continuity cost	50000	1	50000	0.005
						0.005
		Total	**1425000**	**1**	**1425000**	**0.1425**

Human resources and materials can be consultant, facilitator or trainer.

- **Materials and supplies:** E.g., laptops, communication equipment, files, materials for facilitated discussions.
- **Possible additional resources can be:** Translation and Contextualization: Providing materials in multiple languages and adapting content to local contexts can enhance accessibility and relevance.
- **Design and Printing:** Investing in professional design and printing of reports can improve their visual appeal and dissemination.
- **Venue and Refreshments:** Arranging suitable venues and refreshments for meetings, events, and training sessions can contribute to a productive and welcoming environment.
- **Knowledge Sharing Platform:** Establishing a platform for sharing findings, recommendations, and best practices can facilitate knowledge exchange and learning.
- **Individual and Group Support:** Providing dedicated spaces for one-on-one support and group activities/trainings can foster collaboration and capacity building.

SI. No	Suggested interventions	Components	Unit cost (per Year)	Dura-tions (Year)	Total= Unit x Duration	Total Cost (Cr.)
3	Targeted psychosocial aid to children in need (children who are orphaned, semi orphaned, children with disabilities etc.)	Resources required for group and individual activities/ sessions	486000	1	486000	0.0486
		School and community-based programme	216000	1	216000	0.0216
		Life skills training programme	162000	1	162000	0.0162
		Other Direct Costs	216000	1	216000	0.0216
		Total	**1080000**	**1**	**1080000**	**0.108**
4	Extending PSS services to language minorities / migrants / tribal communities	Cultural awareness and competence training for the service providers	105000	1	105000	0.0105
		Targeted PSS Materials and Resources: customized materials, tools, and interventions that are specifically developed to meet the unique needs and cultural context of the population being served.	168000	1	168000	0.0168
		Adapting all materials into local languages and culturally relevant formats	63000	1	63000	0.0063
		Community Psychosocial Capacity Building Program for the local people	84000	1	84000	0.0084
		Total	**420000**	**1**	**420000**	**0.042**

SI. No	Suggested interventions	Components	Unit cost (per Year)	Dura-tions (Year)	Total= Unit x Duration	Total Cost (Cr.)
5	Mental Health & PSS for the elderly, women and persons with disabilities	Support Groups for Elderly individuals (with Facilitator)	25,000	1	25,000	0.0025
		Human resources (Geriatric counselor)	36000	1	36000	0.0036
		Psycho social skills training and community living skill training	45000	1	45000	0.0045
		Create materials for PSS for children with neurodevelopment disorders using the techniques such as alternative and augmentative communication	46000	1	46000	0.0046
		Total	**152000**	**1**	**152000**	**0.0152**
6	Establishing kuttiyidam (child friendly spaces) in schools	Integration of Psychological First Aid (PFA) in Classroom Instruction	30,000	3	90000	0.009
		Toolkits for Child-Friendly Spaces with Psychosocial Theme and activities	65000	3	195000	0.0195
		Total	**95000**	**3**	**285000**	**0.0285**
7	IEC materials & videos on mental health / suicide prevention	Pre-Production: Agency for project management, design, and communication and Meetings, consultations, and finalizing content	150000	1	150000	0.015
		Production	200000	1	200000	0.02
		Post-Production: Translation & Language Adaptation, Final Content Review & Distribution	150000	1	150000	0.015
		Total	**500000**	**1**	**500000**	**0.05**

SI. No	Suggested interventions	Components	Unit cost (per Year)	Dura-tions (Year)	Total= Unit x Duration	Total Cost (Cr.)
8	Psycho-education on substance abuse and de-addiction facilities	Form support group and conduct group activities/ session	11500	3	34500	0.00345
		Workshops & Awareness Programs	9000	3	27000	0.0027
		Skill-building and lifestyle rehabilitation programs	6500	3	19500	0.00195
		Handouts, brochures, and educational materials on substance abuse	3000	3	9000	0.0009
		Other cost	1500	3	4500	0.00045
		Total	**31500**	**3**	**94500**	**0.00945**
9	Art based counseling / therapy orientation cum training to trained counsellors	Human resource & materials	160000	3	480000	0.048
		Possible additional resources	40000	3	120000	0.012
		Other cost	160000	3	480000	0.048
		Total	**360000**	**3**	**1080000**	**0.108**
10	Tribal mental health programme	Training and Capacity Building: Training health workers, mental health professionals. awareness programs, and workshops. Campaigns to reduce stigma and spread awareness.	100000	3	300000	0.03
		Research: Assessing mental health needs and service gaps.	100000	3	300000	0.03
		Service Delivery Planning and Implementation Costs	100000	3	300000	0.03
		Others cost	50000	3	150000	0.015
		Total	**350000**	**3**	**1050000**	**0.105**
11	Strengthening of online helpline facility (including sign language) for MHPSS, Long term system including outreach	Improvement of existing Infrastructure Setup	50000	5	250000	0.025
		Human Resources	100000	5	5,00,000	0.05
		Public Awareness Campaign and MHPSS IEC Materials Development	20000	5	100000	0.01
		Other cost	40000	5	200000	0.02
		Total	**210000**	**5**	**1050000**	**0.105**
12	Preparing a professionally qualified first responders / RRT for psychosocial services in the district	Human resources and materials	65000	3	195000	0.0195
		Possible additional resources	40000	3	120000	0.012
		Total	**105000**	**3**	**315000**	**0.0315**

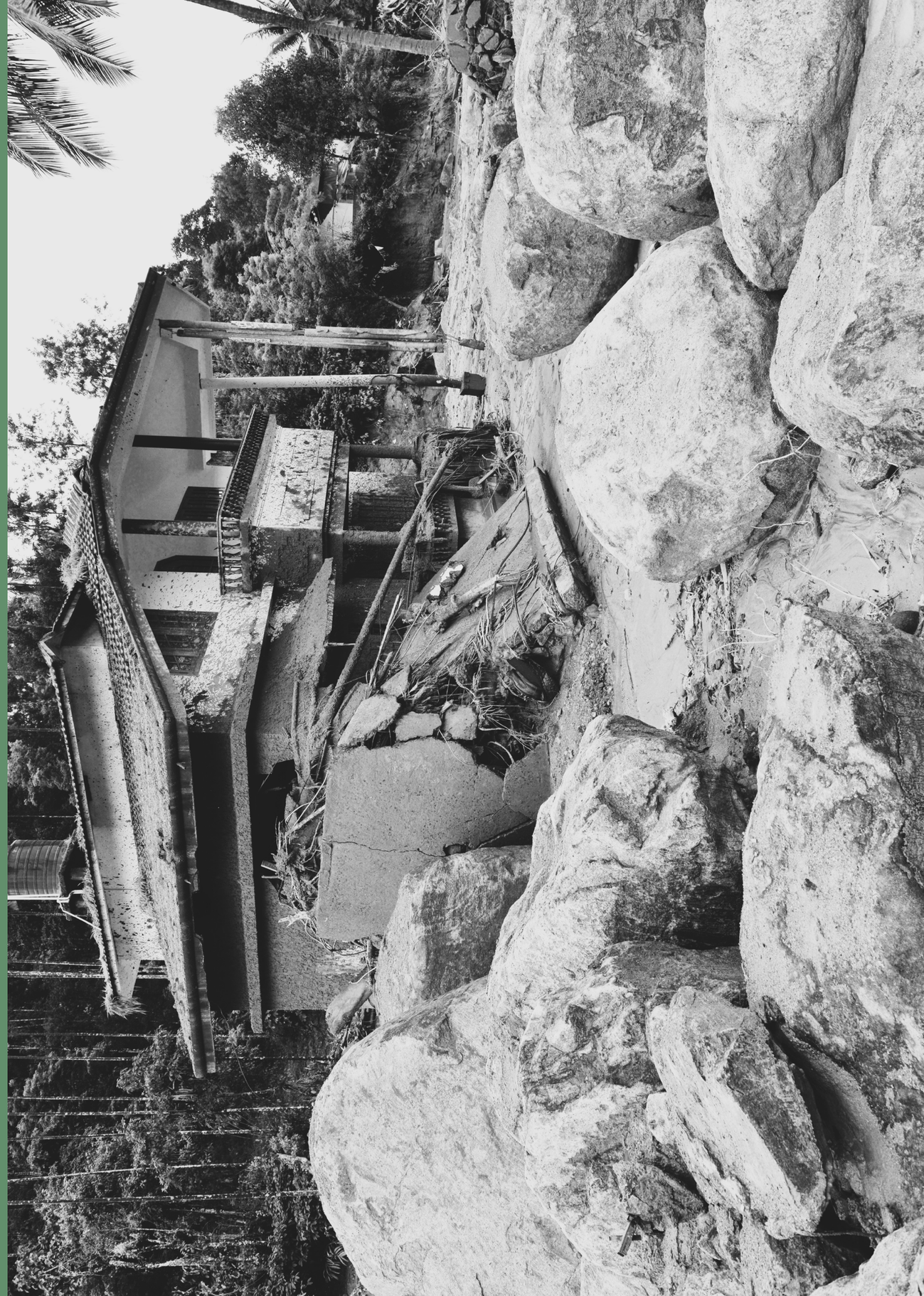
SI. No	Suggested interventions	Components	Unit cost (per Year)	Dura-tions (Year)	Total= Unit*Dura-tion	Total Cost (Cr.)
13	Capacity building of public health staff (ASHA/JPHN/JHI) on psy-chosocial care and mental health	Human resources and materials	65000	3	195000	0.0195
		Possible additional resources	40000	3	120000	0.012
		Total	**105000**	**3**	**315000**	**0.0315**
14	Orientation cum training for grassroot workers like Anganwadi workers, Tribal promoters, com-munity volunteers etc. on MHPSS	Human resources and materials	65000	3	195000	0.0195
		Possible additional resources	40000	3	120000	0.012
		Total	**105000**	**3**	**315000**	**0.0315**
15	Session for first responders (Fire & rescue, Civil Defence, Aapda Mitra, Counsellors, Community volunteers) on mental wellbeing after a screening	Human resources and materials	270000	1	270000	0.027
		Possible additional resources	30000	1	30000	0.003
		Total	**300000**	**1**	**300000**	**0.03**
16	Capacity building for counselors and Social Workers on survival skills & first aid and Mental Health Support Skills	Human resources and materials	150000	5	750000	0.075
		Possible additional resources	80000	5	400000	0.04
		Total	**230000**	**5**	**1150000**	**0.115**

SI. No	Suggested interventions	Components	Unit cost (per Year)	Dura-tions (Year)	Total= Unit x Duration	Total Cost (Cr.)
17	Addressing Climate anxiety in the schools - Awareness sessions in the schools for children & teach-ers	Human resources and materials	300000	1	300000	0.03
		Possible additional resources	170000	1	170000	0.017
		Total	**470000**	**1**	**470000**	**0.047**
18	Training for school teachers and on psychosocial care services / art based therapies	Human resources and materials	300000	1	300000	0.03
		Possible additional resources	150000	1	150000	0.015
		Total	**450000**	**1**	**450000**	**0.045**
19	Orientation to parents of school children on emotional first aid / parenting skills	Human resources and materials	150000	1	150000	0.015
		Possible additional resources	150000	1	150000	0.015
		Total	**300000**	**1**	**300000**	**0.03**

SI. No	Suggested interventions	Components	Unit cost (per Year)	Dura-tions (Year)	Total= Unit x Duration	Total Cost (Cr.)
20	Study and assessment on the impact on mental health post disaster	Human Resources	40000	3	120000	0.012
		Research Activities	30000	3	90000	0.009
		Equipment and Supplies	10000	3	30000	0.003
		Travel	14000	3	42000	0.0042
		Publication and Dissemination	60000	3	180000	0.018
		Administrative Costs	5000	3	15000	0.0015
		Contingency	4000	3	12000	0.0012
		Total	**163000**	**3**	**489000**	**0.0489**
Total (Two crore twenty-nine lakh eighty six thousand five hundred)					**2,29,86,500**	**2.29865**



INFRASTRUCTURE SECTOR



07



Drinking Water and Sanitation

7.1. Basic Profile of the Sector

The recent landslide in Wayanad has had a significant impact on the water supply and sanitation systems in the Meppadi Panchayat, particularly in Wards 10, 11, and 12. These systems are critical infrastructure components that ensure the health, hygiene, and overall wellbeing of local communities. This region builds its water supply system around several key components, including open well systems, bore wells, small drinking water schemes, and gravity fed pipeline networks. These pipelines, often situated in reservoirs along natural water courses, utilize gravity to transport water to households, ensuring a steady supply of clean, safe, and accessible water for daily consumption and other essential activities. The effectiveness of these systems is paramount, given their role in sustaining life and promoting public health in the community.

The geographical diversity of Meppadi, with its hilly terrain and frequent susceptibility to landslides and floods, presents unique challenges to the development and maintenance of water supply and sanitation infrastructure. The rugged landscape complicates the installation of water pipelines and sanitation facilities, making them vulnerable to damage from natural disasters. The recent landslide event has exacerbated these vulnerabilities, disrupting water supply lines and contaminating water sources, thus posing serious risks to the safety and availability of potable water. Additionally, the collapse of sanitation infrastructure can lead to the spread of waterborne diseases, further endangering public health and safety.

Table 7-1: *Baseline information on water supply system*

Name of Water Supply System: Chooralmala Neelikaap Koyinakulam Water Supply Scheme, Dam site water supply scheme , Mattarakkunnu water supply scheme		
Population connected to system %	10.99	
Water users and supply	Water Demand Forecast (litres per year) and Rates (INR. Per litre)	
	Current year	
	Users	Volume (l/ yr.)
Residential (2007 families x 5 No.)	10035	494474625
Industrial (1 tea factory x 20 labour)	20	328500
Schools & Madrassas (2 schools & 2 madrassas)	1500	27375000
Hotels (2 x 20 seats)	40	2920000
Religious Institutes (2 mosque, 1 church, 1 temple)	500	5475000
Shops and establishments (59 shops)	118	430700
Total	12213	531003825

Water Supply Structures: Capacities and Costs		
Rural Water Supply Structures	System Quantity (in numbers)	Number of users
		Families
Treatment plants	0	0
Open well (539 individual wells & 3 community wells)	542	569
Closed Well with Hand Pump	0	0
Rural Water Schemes	3	128
Distribution of Pipelines in km	42.8	
Others (Borewells)	30	30

As Wayanad faces the ongoing impacts of climate change, there is a pressing need for resilient, sustainable approaches to managing water and sanitation systems. This involves not only the restoration of damaged infrastructure but also the incorporation of disaster resilient design principles and innovative solutions that can mitigate the effects of future natural events. Restoring safe and functional water supply and sanitation systems is critical to safeguarding public health and ensuring the community's long-term wellbeing. Moreover, it is essential for fostering sustainable development in the region, as reliable access to clean water and effective sanitation are foundational to economic growth, social stability, and environmental sustainability. By addressing these challenges through proactive planning and investment in resilient infrastructure, the Meppadi Grama Panchayat can enhance its capacity to respond to future disasters, protect its communities, and ensure a sustainable and prosperous future.

Before the landslide disaster, the water supply and sanitation systems in the Meppadi Grama Panchayat, specifically in Wards 10, 11, and 12, were well-established and played a vital role in meeting the daily needs of the local population. The region is characterized by its hilly terrain and abundant water resources, owing to the significant catchment areas of the Punnapuzha river. These natural features have historically provided a reliable source of water for the community, making the region relatively self-sufficient in terms of water supply.

In Ward 10, a total of 165 families depended on open wells as their primary source of water, which tapped into the shallow aquifers prevalent in the region. An additional 5 families relied on bore wells, which were deeper and designed to access groundwater from lower aquifers, providing an alternative source during dry periods or when shallow wells ran low. The remaining households in this ward benefited from a gravity fed water supply system. This system capitalized on the natural downhill flow of water from higher altitudes, allowing it to be delivered directly to homes without the need for mechanical pumping. This gravity based system not only provided a consistent supply of water but also minimized operational costs and maintenance requirements.

In Ward 11, the water supply dynamics were slightly different, with 185 families depending on open wells and 12 on bore wells. The reliance on open wells indicates the availability of shallow groundwater in this area, which was easily accessible and sufficient for most daily water needs. Similar to Ward 10, the other families in Ward 11 depended on the gravity water flow system, which ensured a steady supply of water, leveraging the natural topography to maintain flow without mechanical intervention.

Ward 12 followed a similar pattern, with 192 families relying on open wells and 13 on bore wells for their water needs. The majority of the remaining households utilized the gravity fed water system, which was particularly effective in the hilly terrain of Meppadi Grama Panchayat. The combination of these water sources—open wells, bore wells, and gravity fed systems—ensured that most families had reliable access to water, regardless of seasonal variations or minor disruptions.

For sewage disposal, most houses across all three wards used soak pits, which are simple, cost effective systems designed for rural settings. Soak pits allow for the safe disposal of liquid waste by enabling it to percolate into the ground, thus minimizing the risk of groundwater contamination and ensuring the effective management of household wastewater. ***Table 7-1*** provides baseline data on the water supply systems in the region. It was observed that there were 10 community toilets in the affected area, which were used by 2000 users at different times. ***Table 7-1*** details the specific numbers and types of water sources utilized by the households.

Overall, the pre-disaster water supply and sanitation infrastructure in Meppadi Grama Panchayat were well adapted to the local terrain and hydrological conditions. The systems were designed to leverage natural resources efficiently while ensuring that the needs of the community were met. However, the landslide disaster has highlighted the vulnerabilities of these systems, particularly their susceptibility to damage from natural calamities, underscoring the need for more resilient and adaptable infrastructure moving forward.

7.2. Sectoral Policies

Before the landslide disaster, the drinking water supply in Meppadi Grama Panchayat, specifically in the affected Wards 10, 11, and 12, was managed through a combination of traditional water sources and dedicated small scale drinking water supply schemes. Water management is a state responsibility, and the State Government is tasked with ensuring that every resident has access to a minimum quantity of potable water. To fulfill this mandate, various water supply schemes were implemented to supplement the traditional water sources and ensure consistent and reliable access to safe drinking water for all households, regardless of their access to groundwater sources such as open wells or bore wells.

Apart from the widespread use of gravity fed water systems that utilized natural water flows from higher elevations, three small drinking water supply schemes were operational in the affected areas. These schemes were designed not just for families without access to groundwater but were available to all residents to ensure equitable access to potable water across the community.

1. Neelikaap Water Supply Scheme (Ward 12):

The Neelikaap water supply scheme, located in Ward 12 of Meppadi Grama Panchayat, was implemented by the local Grama Panchayat and it benefited 38 families. This scheme provided a dedicated source of drinking water to households in the area, ensuring that all residents, regardless of their proximity to natural water sources or existing groundwater availability, had access to safe and reliable drinking water. The implementation of this scheme by the Panchayat reflects a commitment to addressing the water needs of the community comprehensively and equitably.

2. Dam Site Water Supply Scheme (Ward 10):

The Dam Site water supply scheme, situated in Ward 10, provided drinking water to 20 families. The scheme was an integral part of the local water infrastructure, designed to complement the gravity fed systems and groundwater sources. It played a crucial role in ensuring that residents in the Dam Site area had a reliable source of potable water, particularly in regions where natural water flow might not be sufficient to meet all the daily needs.

3. Mattarakkunnu Water Supply Scheme (Ward 10):

The Mattarakkunnu water supply scheme in Ward 10, served 70 families. This scheme was one of the larger drinking water projects in the ward, designed to provide a stable water supply to a significant portion of the community. Like the other schemes, Mattarakkunnu was available to all residents in its coverage area, ensuring that the availability of safe drinking water was not limited to only those without groundwater access. The scheme's design aimed to enhance water security and reduce dependency on a single source of water, thereby providing a more resilient approach to water supply.

In addition to these localized water supply schemes, the Jal Jeevan Mission (JJM)—a Central Government initiative was also positioned to support the establishment of new water supply schemes or to augment existing ones, particularly in the development of new townships or in response to growing water demands. Overall, the water supply schemes in the pre-disaster context of Meppadi Grama Panchayat were designed to ensure that all families had access to clean drinking water, regardless of their reliance on traditional groundwater sources. These schemes reflected a proactive and inclusive approach to water management, aiming to provide reliable and safe water access to every household. The landslide disaster, however, has disrupted these systems, highlighting the need for robust, disaster resilient water supply infrastructures to safeguard the community's access to potable water in the face of future challenges.

7.3. Damage in the Sector

Water Supply

The recent landslide in Meppadi Grama Panchayat has had a profound impact on the region's water supply and sanitation infrastructure. The assessment aimed to meticulously evaluate the extent of damage across various components of these systems, focusing on both public and private infrastructure. The data for this assessment was collected from local Grama Panchayat records and through field observations.

Ground Water Source

The landslide and subsequent flooding have inflicted significant damage on various groundwater sources, which include open wells, bore wells, closed wells with storage, and electric water pumps. The landslide has led to the contamination of well water with pollutants and debris. This contamination, compounded by the influx of sediments, has rendered the water unsafe for consumption. In several instances, the structural integrity of open wells has been compromised due to the force of the landslide induced floodwaters, leading to potential irreparable damage. The assessment indicates that many of these wells, particularly those affected by heavy siltation and debris, are now unusable. Furthermore, the electrical components of water pumps associated with closed wells have been severely damaged, making them non-functional.

Tap stands, crucial for community water distribution, have suffered damage or been washed away entirely. Boreholes, which are critical for water supply, have had their pumping mechanisms disrupted, rendering them unusable

Table 7-2: *Damage details of open well and bore well*

Sl. No.	Name of ward	Total well (No.)		Damaged well (No.)	
		Open well	Bore well	Open well	Bore well
1	10	165	5	60	0
2	11	185	12	30	6
3	12	192	13	50	4
Total		**542**	**30**	**140**	**10**

until extensive repairs are undertaken. Given the extent of the damage and the designation of the area as a no-go zone, the feasibility of revamping the water supply system is severely limited. The details of the damage to open wells and bore wells are documented in ***Table 7-2***, with a comprehensive summary of all damage provided in ***Table 7-6***.

Water Supply Scheme

The affected area previously had three small drinking water supply schemes:

- Neelikaap: Located in Ward 12, this scheme served 38 families.
- Dam Site: Situated in Ward 10, this scheme benefited 20 families.
- Mattarakkunnu: Located in Ward 10, this scheme served 70 families.

The recent landslide has had a devastating impact on the Dam Site and Mattarakkunnu water supply schemes. Both schemes have experienced severe damage to their wells, pump houses, pump sets, pumping mains, and distribution lines. The infrastructure associated with these schemes has been critically impaired, making them largely non-functional. Although the Neelikaap water supply scheme was not directly affected by the landslide, the relocation of its beneficiaries to transient shelters means that this scheme can no longer serve its purpose. Therefore, all three schemes are rendered unusable. The extent of the damage to these water supply schemes is detailed in ***Table 7-6***.

Gravity Controlled water pipelines

The gravity controlled water pipelines are crucial components of the water supply system in Meppadi Grama Panchayat. These pipelines are designed to extract water from natural sources, such as rivers and streams, and distribute it to the community for various uses, including drinking. The gravity controlled pipeline system extends for approximately 42 kilometres, running from Punchirimattam to Chooralmala. This system is vital for water supply schemes that do not rely solely on boreholes and open wells. According to the assessment, nearly 60% of the existing gravity controlled water pipeline network has sustained damage. The damage includes sections that have been either completely washed away or severely compromised, affecting the overall water distribution capacity.

Pump sets

Pump sets are vital for elevating water from lower to higher elevations, which is essential in Meppadi's mountainous terrain. These pumps are installed at lower points near water sources such as open wells and tube wells and are responsible for lifting water to elevated storage tanks on the roof of the buildings. The landslide has severely impacted 140 open wells and their pump sets, while 104 open wells and their pump sets have been partially affected. Additionally, 10 bore wells have been completely destroyed, and the pump sets and motors submerged in these wells are lost. The disaster's intensity has led to the destruction of a significant number of water pumps, halting the operation of water supply schemes. The details of the damaged pump sets are outlined in ***Table 7-3***.

The recent catastrophe has inflicted significant damage on the water pumps, including the associated motors housed within the pump houses. The disaster's intensity led to the destruction of a considerable number of water pumps, leading to a complete halt in the operation of water supply schemes. These pumps vary in terms of types and capacities, catering to diverse needs across different areas.

Pump house

The robustness of the pump house structures has been notably compromised, exhibiting a range of damages that differ from one location to another. The extent and type of damage vary, indicative of the multifaceted consequences of the disaster. It is imperative to conduct individualized assessments for each pump house to comprehensively depict the actual extent of damage and accurately portray the prevailing situation. Discussions with Panchayat authorities indicated that the pump houses associated with the Mattarakkunnu and Dam Site water supply schemes are severely damaged. The Neelikaap pump house also needs to be abandoned due to the relocation of beneficiaries. ***Table 7-4*** outlines the damage to pump houses in various water supply schemes in the affected area that is wards 10,11, and 12 of Meppadi grama panchayat.

Pipeline

The gravity controlled water pipelines play a crucial role in the water supply schemes across the Panchayat, except for those relying solely on boreholes and open wells. According to the assessment, nearly 60% of the existing gravity controlled water supply facility has suffered damage. The pipeline system associated with the Mattarakkunnu and Dam Site water supply schemes has been either washed away or severely damaged, resulting in the loss

Sl. No	Name of the Scheme	Pump set	
		Total Number	Damage in Number
1.	Mattarakkunnu water supply scheme	2	2
2.	Dam site water supply scheme	2	2
3.	Neelikaap Chooralmala Koyinakulam water supply scheme	2	0

Table 7-3: *Details of pump set damaged*

Sl no	Name of the Scheme	Pump House	
		Total Number	Damage in Number
1.	Mattarakkunnu water supply scheme	1	1
2.	Dam site water supply scheme	1	1
3.	Neelikaap Chooralmala Koyinakulam water supply scheme	1	0

Table 7-4: *Details of pump house damaged*

Table 7-5: Damage details of pipeline

Sl. No	Name of the scheme	Approximate length of the pipeline damaged(km)	Damage Cost (Cr.)
1	Mattarakkunnu WSS	1.8	0.063
2	Dam site WSS	0.9	0.0315
3	Neelikaap WSS	0	0
4	Gravity water line	42.8	0.04
Total			**0.1345**



Figure 7-1: *Damaged pipelines*

Table 7-6: Water supply damage assessment details

Damage to Structures and Assets	Fully Damaged (> 70 % damage)		Severely Damaged (30 -70% damage)		Partially Damaged (< 30% damage)	
	Number of Fully Damaged	Average Replacement Cost (Cr.)	Number of Severely Damaged	Average Repair Cost (Cr.)	Number of Partially Damaged	Average Repair Cost (Cr.)
	A	B	C	D	E	F
Estimated Damages of Rural Water Supply System						
Treatment plants	0	0				
Open well	140	2.10				
Bore well	10	0.15				
Closed Well with Hand Pump	0	0				
Rural Water Schemes	3	0.70				
Distribution Pipelines in km (Gravity controlled)	42.8	0.04				
Equipment in open well	140	0.35	104	0.26		
Equipment in Bore well	10	0.04				
TOTAL		**3.38**		**0.26**		
Grand Total	**3.64**					

of approximately 2.7 kilometers of pipeline in these two schemes. The details of the damage to the pipelines are provided in ***Table 7-5*** and ***Figure 7-1*** shows the damaged pipelines after the disaster.

7.4. Sanitation System

Meppadi, having been declared an Open Defecation Free (ODF) Panchayat, had toilets in all households and public buildings. This comprehensive sanitation coverage included 2007 individual household toilets and several community toilet complexes in schools, Anganwadis, religious centers, and commercial buildings. The landslide has resulted in the loss of 498 individual household toilets and 10 community toilet complexes.

The damage to these facilities has significant implications for public health and hygiene, particularly in the affected wards. Details of the damaged sanitary facilities are presented in ***Table 7-7***.

This detailed assessment provides a clear picture of the extensive damage to water supply and sanitation systems in Meppadi Grama

Panchayat. The abstract of loss and damage is provided in ***Table 7-8***. The findings underscore the severe impact of the landslide and the substantial challenges facing restoration and rehabilitation efforts.

Socio – Economic Impact on People

The recent landslide and subsequent flooding in Meppadi Grama Panchayat have caused widespread devastation, severely impacting the water supply and sanitation infrastructure across Wards 10, 11, and 12. The disaster has led to substantial damage to the essential services that communities rely on for their daily needs, highlighting the fragility of these systems in the face of extreme natural events. Impact on water supply systems, sewer and sanitation system and housing and community displacement post disaster are given below.

Impact on Water Supply Systems

The aftermath of the disaster has revealed extensive damage to over half of the existing water supply schemes in the affected wards. The gravity of the landslide's impact has been most pronounced on two key water supply schemes:

- Dam Site Water Supply Scheme (Ward 10): This scheme has suffered extensive damage and is beyond repair. The wells, pump house, pump set, pumping mains, and distribution lines have been heavily impacted, rendering the system non-functional. The destruction of the infrastructure means that the 20 families who relied on this water supply scheme no longer have access to their regular water source.

- Mattarakkunnu Water Supply Scheme (Ward 10): Similar to the Dam Site scheme, the Mattarakkunnu water supply scheme has been severely damaged. The flooding caused by the landslide has destroyed critical components, including the wells, pump house, pump set, and the entire distribution network. This has left 70 families without a reliable water source, compounding the challenges faced by the local community in the disaster's aftermath.

- Neelikaap Water Supply Scheme (Ward 12): While the lift water system at Neelikaap itself has not been notably affected by the landslide, the relocation of its beneficiary group to transient shelters has made this water supply scheme effectively unusable. As the families who benefited from this scheme are no longer residing in their original homes, the operational necessity of the Neelikaap scheme has been nullified for the time being.

In addition to the damage sustained by these specific water supply schemes, the gravity fed water distribution system that served Wards 10, 11, and 12 has been completely destroyed. The pipelines that were integral to this system have been washed away, making the gravity fed supply network entirely inoperative. This has resulted in a total loss of water supply to numerous households that depended on the natural flow of water from elevated sources.

Furthermore, most of the open wells in the affected areas have been filled with silt and debris due to the landslide and flooding, rendering them unusable. This widespread silting has cut off a critical water source for many families. Additionally, some tube wells have also become non-operational, further reducing the available water supply options for residents. The combined effect of these damages has left a significant portion of the population without access to clean and safe drinking water, exacerbating the already dire situation.

Impact on Sewer and Sanitation Systems

The force of the floodwaters resulting from the landslide has also caused extensive damage to the sewer network. Structural damage, erosion, have been reported throughout the system, significantly impairing its functionality. In regions where the sewer infrastructure has been most compromised, the risk of waterborne diseases has increased, necessitating urgent remedial action to mitigate these threats and protect community health.

Impact on Housing and Community Displacement

The landslide has not only affected the water and sanitation systems but has also resulted in substantial damage to housing in Meppadi Grama Panchayat. The disaster has rendered many houses uninhabitable, forcing many fam-

Table 7-7: *Damage details of sanitation system*

Damage to Structures and Assets	Fully Damaged		Severely Damaged		Partially Damaged	
	Number of Fully Damaged	Average Replacement Cost (Cr.)	Number of Severely Damaged	Average Repair Cost (Cr.)	Number of Partially Damaged	Average Repair Cost (Cr.)
	A	B	C	D	E	F
Estimated Damages of Rural Water Supply System						
Community Toilets with soak pits	10	0.10				
Others	0	0				
TOTAL		**0.10**				

Sl. No.	Component	Damage in Cr.	Loss in Cr.	Total damage and loss (Cr.)
1	Treatment plants	0	0	0
2	Open well	2.10	0	2.1
3	Bore well	0.15	0	0.15
4	Closed Well with Hand Pump	0	0	0
5	Rural Water Schemes	0.70	0	0.70
6	Distribution Pipelines in km (Gravity controlled)	0.04	0	0.04
7	Equipment in open well	0.61	0	0.61
8	Equipment in Bore well	0.04	0	0.04
9	Community Toilets	0.10	0	0.10
Total		**3.74**	**0**	**3.74**

Table 7-8: *Abstract of Loss and damage in drinking water and sanitation sector*

ilies to be relocated to transient shelters. This relocation has added to the complexity of managing water supply and sanitation needs, as these families are now concentrated in temporary accommodations that may not have adequate infrastructure.

The recent landslide event in Meppadi Grama Panchayat caused widespread destruction, significantly affecting residential infrastructure in Wards 10, 11, and 12. Data collected from the local self-government authorities highlights the severity of the damage inflicted upon these areas, with a total of 2,007 houses destroyed. This extensive damage assessment is crucial for planning and executing effective relief, rehabilitation, and reconstruction efforts to restore the affected communities. The detailed breakdown of the damaged houses is provided in ***Table 7-9***.

Given the severity of the damage, the Technical Committee conducted a comprehensive assessment of the affected area. The committee marked the "go" and "no-go" zones, covering an area of almost 20 square kilometres. This assessment has led to the conclusion that restoration of the damaged water supply and sewer systems in these areas is impractical and unfeasible. The extensive damage, combined with the risks associated with ongoing instability and potential future landslides, renders efforts to rebuild the existing infrastructure meaningless. The post-disaster scenario in Meppadi Grama Panchayat presents significant challenges in restoring essential services and ensuring the safety and wellbeing of the affected population. The widespread damage to water supply and sanitation systems necessitates a comprehensive and strategic approach to recovery and rehabilitation. There is an urgent need for developing resilient and adaptable infrastructure that can withstand future natural disasters, protect public health, and support the sustainable development of the region.

7.5. Response by the Government

In the wake of the recent landslide in Meppadi Grama Panchayat, the Wayanad District administration, in collaboration with local and state agencies, mounted a comprehensive and coordinated response to ensure the safety, wellbeing, and basic needs of the affected population. The disaster response efforts were multi-faceted, focusing on the immediate evacuation and relief of displaced families, maintaining essential services such as water supply and sanitation, and ensuring proper waste management in the relief camps.

Evacuation and Shelter Management

The first priority of the Wayanad District administration and Meppadi Grama Panchayat was to evacuate families from the affected and landslide-prone areas to safer locations. To this end, a rapid evacuation was carried out, moving all affected families to relief and rescue camps established in various schools across Meppadi, Kalpetta, and Muttil Grama Panchayats. The selection of these locations was strategic, ensuring that the camps were located in relatively safe areas away from the immediate threat of further landslides or flooding. The swift evacuation and relocation of families to these

Sl. No	Ward No.	Fully Damaged (damage more than 70%)	Severely Damaged (damage range between 70% and 30%)	Minor Damage (less than 30%)	Grand Total (No.)
1	10	689	31		720
2	11	486	18		504
3	12	125	55	603	783
Total		**1300**	**104**	**603**	**2007**

Table 7-9: *Details of the total number of damaged houses (fully damaged/ severely damaged/ minor damage houses) in the Meppadi Grama panchayat.*

camps were crucial in preventing casualties and ensuring the safety of the affected residents.

Ensuring Water Supply and Sanitation in Relief Camps

Recognizing the critical importance of uninterrupted water supply and adequate sanitation facilities in the relief camps, several agencies, including the Kerala Water Authority and Swachh Bharat Mission, played a pivotal role in managing these essential services:

The Kerala Water Authority took immediate action to ensure a consistent and reliable water supply to all relief camps. Given the damage to the local water supply infrastructure caused by the landslide, the authority utilized water tankers to deliver potable water directly to the camps. This proactive measure was vital in maintaining hygiene and preventing the outbreak of waterborne diseases, especially in a crowded camp environment. Additionally, with support from various non-governmental organizations, the Kerala Water Authority provided High-Density Polyethylene (HDPE) storage tanks and set up distribution facilities within the camps. These storage tanks enabled the safe storage of water, ensuring that there was always an adequate supply to meet the daily needs of the displaced families.

In parallel with efforts to secure water supply, the Swachh Bharat Mission (SBM) provided bio-toilets in all relief camps and in the rescue area at Chooralmala. These bio-toilets are a sustainable sanitation solution, particularly in emergency situations, as they do not require connection to traditional sewage systems and are less likely to contaminate groundwater. The provision of bio-toilets ensured that camp residents had access to clean and safe sanitation facilities, which is critical in preventing the spread of diseases in overcrowded conditions.

The Haritha Karma Sena, a local volunteer force dedicated to waste management and sanitation, was entrusted with maintaining the cleanliness of the toilets and the surrounding premises round the clock. This involved regular cleaning and disinfection of toilets, ensuring that hygiene standards were upheld despite the high usage rates in the relief camps. Their continuous presence and diligent work were instrumental in maintaining a sanitary environment in the camps, thereby safeguarding the health of the displaced population.

Collaboration with Non-Governmental Organizations (NGOs/IAGs)

The response efforts were significantly bolstered by the collaboration with various non-governmental organizations (NGOs) and Inter Agency Groups (IAGs). These organizations provided critical support in the form of resources, manpower, and expertise, complementing the efforts of government agencies. Their contributions included the provision of additional HDPE storage tanks, assistance in setting up water distribution networks within the camps, and support in managing the logistics of food and other essential supplies. The involvement of the organizations was a testament to the importance of multi-sectoral collaboration in effective disaster management and recovery.

Limitations

The PDNA conducted for Meppadi in the aftermath of the recent landslide aimed to provide a comprehensive analysis of the disaster's impact on the water supply and sewer system infrastructure. While the assessment succeeded in documenting significant damages and facilitating a better understanding of the necessary recovery efforts, several limitations impacted the scope and accuracy of the findings. These limitations highlight the challenges of conducting such assessments in complex and dynamic disaster affected environments.

- Complexity of Infrastructure.
- Incomplete Data on Private Infrastructure.
- Limited documentation of private sewer components.
- Reliance on local sources.

The assessment relied heavily on information from local panchayat authorities and community members, including the Panchayat President, Members, Secretary, and local stakeholders like the ADS President and MGNREGS staff. Reliance on informal sources may have led to incomplete or biased data, as not all areas could be thoroughly assessed even though it is valuable.

7.6. Reconstruction and Recovery Needs

The reconstruction of the water supply and sanitation systems is a critical aspect of developing a new township. The township is expected to accommodate up to 2,000 families, making the provision of reliable water and sanitation infrastructure an essential priority.

The following recommendations outline a comprehensive plan for rebuilding these systems in a sustainable and resilient manner.

- Customized Reconstruction Approach: A customized approach to the reconstruction of water supply and sanitation systems is paramount. The initial step involves a thorough assessment of existing infrastructure to distinguish between assets that are repairable and those that have exceeded repairable limits. This differentiation is crucial to optimize resource allocation and ensure that efforts are focused on sustainable reconstruction.

- Site Specific Reconstruction Strategy: The reconstruction strategy should include comprehensive hazard mitigation measures tailored to the specific vulnerabilities of the region. Given the area's susceptibility to natural disasters such as floods, landslides, it is essential to design water and sanitation infrastructure that can withstand such events. For instance, lift water schemes located near rivers should incorporate robust flood protection measures. Furthermore, considering the feasibility of relocating critical infrastructure to less vulnerable areas should be a priority to reduce future risks.

- Integration of Multi-Hazard Mitigation: All restoration efforts must integrate multi-hazard mitigation measures from the outset. This involves adopting engineering solutions that cater to a range of potential threats. The implementation of these measures should begin at the design phase and continue through construction and maintenance, ensuring that new infrastructure is resilient to a variety of hazards. For example, gravity fed pipelines could be buried deeper underground to reduce exposure to landslides.

Forecasting Water Demand for the New Township

To adequately provide drinking water and sanitation facilities in the new township, it is crucial to forecast the total water demand based on the projected population and the institutions that will be established in the area. The water demand will vary depending on the type and number of facilities, including schools, hospitals, commercial establishments, and residential units.

The forecasted water demand for the upcoming township is detailed in ***Table 7-10***. This estimation will guide the design and capacity planning for the new water supply system, ensuring that it can meet both current and future needs. For instance, the township may require multiple water sources and rainwater harvesting systems, to provide a reliable and sustainable water supply throughout the year.

Based on the current estimates, the township is projected to require a water supply of approximately 1.67 million liters per day (MLD). However, to accommodate potential increases due to population growth and community living dynamics, the water supply system should be designed with a capacity of up to 2 MLD. This design capacity ensures that the township can adequately meet the needs of all its residents under varying conditions, including peak demand periods.

The phased relocation plan for the families affected by the landslide is as follows:

- **Phase 1**: Relocation of 600 families
- **Phase 2**: Relocation of an additional 600 families
- **Phase 3**: Relocation of the remaining 800 families

The staggered approach to relocation ensures that the infrastructure development aligns with the increasing population, allowing for incremental improvements and expansions as needed.

Water Supply Scheme Design

- Water Treatment and Distribution System:

Water Demand for Developing a Township - Phase 1				
Sl. No	**Component**	**Water demand**	**Users**	**Total water demand (LPD)**
1	House (600)	135	3000	405000
2	School (1-12)	50	800	40000
3	Community Hall			5000
4	Waste Water Treatment Plant			1000
5	Anganwadi	30	40	1200
6	Health centre including ayurveda dispensary	300	10	3000
7	Clinic	300	10	3000
8	Hotel	200	20	4000
9	Workshop & Service Center	150	25	3750
10	Other Commercial area			3000
11	Children's Park			5000
12	Play Ground			2000
13	Govt Office complex	70	100	7000
14	Skill Training centre/ Handicraft Center	50	100	5000
15	Prayer Halls – 3	30	4000	120000
	Total			**607950**
Reconstruction of Township - Phase 2				
Sl. No	**Component**	**Criteria**	**Users**	**Total water demand (LPD)**
1	House (600)	135	3000	405000
5	Anganwadi	30	60	1800
13	Prayer Halls – 2	30	4000	120000
	Total			**526800**
Reconstruction of Township - Phase 3				
Sl. No	**Component**	**Criteria**	**Users**	**Total water demand (LPD)**
1	House (800)	135	4000	540000
	Grand Total			**1674750**

Table 7-10: *Forecasted water demand for the upcoming township*

Table 7-11: *Cost of Components for water supply system*

Sl. No.	Components	Unit Cost in INR	Quantity	Cost (Cr.)	Time-line
1	Raw water pump house (5m diameter & 12m depth) at Karappuzha reservoir	5,00,000/m/depth	12 M	0.6	12 Months
2	Pumps and Motors including standby for boosting station (120 HP VT slow speed 100m Head pump set)	24,000/HP	240 HP (120HPX2)	0.576	12 Months
3	Soft starter with electrical components including standby	2,500/HP	240(120HPX2)	0.06	12 Months
4	LT Powerline extension, 250 KWA LT Transformer with power connection for raw water pumphouse (transformer yard, panel board, power line extension, power connection, earthing, etc)	25,00,000/unit	1	0.25	12 Months
5	300 DIK9 Pumping main - raw water to WTP (10km including necessary sluice valves, NRV, manholes, valve chamber, anchor blocks etc)	6,550/m	10000m	6.55	12 Months
6	Water treatment plant 2MLD	1,05,00,000/MLD	2	2.1	12 Months
7	Booster pump house with RCC GL Tank (clear water) 1.50 lakh litre	22/l	120000	0.264	12 Months
8	LT Powerline extension, 200 KWA LT Transformer with power connection for Booster pump house (transformer yard, panel board, power line extension, power connection, earthing, etc)	20,00,000/Unit	1	0.2	12 Months
9	75 HP VT Pumps and motors including standby for boosting station slow speed 100 M head	4,000/HP	150	0.06	12 Months
10	Chlorination unit for water purification	5,00,000/unit	2	0.1	12 Months
11	Clear water pumping main from WTP to overhead tank 300 DI	6,550/M	10000 M	6.55	12 Months
12	RCC Overhead tank of capacity 3.00 lakh l	24/l	300000 l	0.72	12 Months
13	Distribution line using 110 mm and 90 mm PVC pipe	1750/M	5000 M	0.875	12 Months
14	Providing water connection to 1000 households with additional length of connection line	8000/Equipment	1000 Nos	0.8	12 Months
15	Providing HDPE storage tank to 1000 house holds	10/l	1000x500	0.5	12 Months
16	Road cutting and road restoration charges (average of BT & BMBC, Irish, Berm cutting charge)	3,280/M^2	11400 M^2	3.74	12 Months
	Unforeseen items			0.055	
Total				**24**	

The water supply scheme will incorporate advanced technologies to ensure the efficient treatment and distribution of water to all households and public amenities within the township. The system, with a capacity to treat 2 MLD of water, will include modern technologies to deliver safe, clean drinking water.

The estimated cost for implementing this water treatment facility is approximately INR 24 Cr. The detailed cost estimate of the components of the water supply scheme is shown in ***Table 7-11***. This investment is crucial to provide uninterrupted access to potable water, thereby enhancing the overall quality of life for residents.

- Rainwater Harvesting Systems:

To complement the main water supply, a rainwater harvesting system will be installed across the township. This system will either be a single unit serving the entire township or multiple units distributed across different clusters, depending on the layout and geographic considerations.

The rainwater harvesting structures are designed to collect up to 1 MLD of water, significantly contributing to water availability during the dry season and aiding irrigation. By leveraging rainwater, the township can mitigate water scarcity issues, particularly in summer, while promoting agricultural productivity.

The cost for setting up the rainwater harvesting infrastructure is projected to be around INR 7 Cr. This system is an environmentally sustainable solution that not only conserves water but also supports green initiatives within the township. The detailed cost estimate of the components of the water supply scheme is shown in ***Table***

Table 7-12: *Cost of Components for Rainwater Harvesting System*

Cost of Components for Rainwater Harvesting System - Phase 1					
Sl. No.	**Components**	**Cost per Equipment in INR**	**Nos**	**Amount in (Cr.)**	**Timeline**
1	Conveyance system including gutters, downspouts, collection pipes -PVC etc Rain gutter 20 Mx600 - 1200 M Down spouts from gutter - 2x4 = 8 x600 - 480 M carrier pipe from down spout to Streat carrier pipe 90 mm PVC - 10 x600 = 6000 M Streat carrier pipe 140 mm PVC pipe - 1500 M	16,600	600	1.000	12 Months
2	Filter units	3,30,000	3	0.099	12 Months
3	RCC Storage tank - 1.20 lakh capacity(18/l)	21,60,000	3	0.648	12 Months
4	Chlorination unit for water purification	5,00,000	3	0.150	12 Months
5	Pumping arrangements for reusing including pump house 15 HP Pump set including power connection charges, pipe arrangements etc complete	3,20,000	3	0.096	12 Months
6	Unforeseen items			0.007	
	Total			**2.00**	

Cost of Components for Rainwater Harvesting System - Phase 2					
Sl. No.	**Components**	**Cost per unit in INR**	**Nos**	**Amount in (Cr.)**	**Timeline**
1	Conveyance system including gutters, downspouts, collection pipes -PVC etc Rain gutter 20 Mx600 - 1200 M Down spouts from gutter - 2x4 = 8 x600 - 480 M carrier pipe from down spout to Street carrier pipe 90 mm PVC - 10 x600 = 6000 M Street carrier pipe 140 mm PVC pipe - 1500 M	16,600	600	1.000	12 Months
2	Filter units	3,30,000	3	0.099	12 Months
3	RCC Storage tank - 1.20 lakh capacity(18/l)	21,60,000	3	0.648	12 Months
4	Chlorination unit for water purification	5,00,000	3	0.150	12 Months
5	Pumping arrangements for reusing including pump house 15 HP Pump set including power connection charges, pipe arrangements etc complete	3,20,000	3	0.096	12 Months
6	Unforeseen items			0.007	
	Total			**2.00**	

Cost of Components for Rainwater Harvesting System - Phase 3					
Sl. No.	**Components**	**Cost per unit in INR**	**Nos**	**Amount in (Cr.)**	**Timeline**
1	Conveyance system including gutters, downspouts, collection pipes -PVC etc Rain gutter 20 Mx800 - 1600 M Down spouts from gutter - 2x4 = 8 x800 - 640 M carrier pipe from down spout to Street carrier pipe 90 mm PVC - 10 x800 = 8000 M Street carrier pipe 140 mm PVC pipe - 2000 M	19,500	800	1.560	12 Months
2	Filter units	3,33,000	4	0.133	12 Months
3	RCC Storage tank - 1.50 lakh capacity(18/l)	21,50,000	4	0.860	12 Months
4	Chlorination unit for water purification	5,00,000	4	0.200	12 Months
5	Pumping arrangements for reusing including pump house 20 HP Pump set including power connection charges, pipe arrangements etc complete.	3,35,000	4	0.134	12 Months
6	Unforeseen items			0.113	
	Total			**3.00**	
Grand Total				**7.00**	

7-12

Sanitation and Public Amenities

While individual toilets will be constructed within residential units, the township will feature well-built public toilet complexes to serve community spaces such as schools, government offices, Anganwadis, parks, playgrounds, and cultural complexes. Each complex will be equipped with separate facilities for men, women, and special provisions for persons with disability and transgenders, ensuring inclusivity and accessibility. These complexes will also include amenities such as urinals, toilets, bathrooms, changing rooms, and feeding rooms, designed to meet international standards of hygiene and convenience.

The cost of constructing one such comprehensive toilet complex is estimated to be around INR 25 lakhs. These facilities will play a critical role in maintaining public hygiene and preventing sanitation related health issues.

The comprehensive cost estimate for establishing robust drinking water and sanitation facilities in the township is detailed in ***Table 7-13***. The investment in these sectors is not merely a financial outlay but a commitment to fostering a healthy, sustainable, and resilient community. The planned facilities and infrastructure are aligned with the highest standards of modern urban planning, ensuring the new township is equipped to handle future growth and environmental challenges.

Recovery Cost

The total estimated recovery cost for training and capacity building in the drinking water and sanitation sector comes to INR 5 Cr. This covers essential programs, including training for engineers and officials in advanced sanitation techniques, community-based trainers in hygiene promotion, and staff preparedness for disaster management. Additionally, the cost includes conducting multiple capacity-building workshops on water resource management, sanitation system upgrades, and public health awareness. Construction of a water quality testing lab is also incorporated in this head. Development of training materials, including e-learning modules and interactive mobile apps, is also included to enhance knowledge dissemination. Infrastructure setup for training, such as renting training centres and providing accommodation for participants, has been accounted for. Monitoring and evaluation components include post-training assessments and field

Sl. No	Component	Cost (Cr.)	Timeline
1	Water supply system including raw water pump house, pumping system, power line extension HT, pumping main, WTP, GL clear water tank with boosting pumping station, clear water pumping main, OH tank with distribution line and household connections and road restoration charges	24	12 Months
2	Rain water harvesting structure that is to collect rain water from all the buildings in the township and stored in different clusters and can be used for irrigation and other household purposes except drinking in summer season	7	12 Months
3	Community toilets in school, Anganwadi, community hall, government office complex, playground, children's park, commercial area etc (10 No. @ 25 lakh)	2.5	12 Months
	Total	**33.5**	

Table 7-13: *Cost of amenities for water and sanitation in township*

Table 7-14: *Cost estimate for training and capacity building*

Components	Cost per Unit in INR	Nos	Amount in (INR.)	Amount in Cr.
Training Programs				
Basic water quality testing for field staffs	5,000	150	750000	0.075
Advanced sanitation techniques trainings for engineers	8,000	50	400000	0.04
Hygiene promotion training for community-based trainers	5,000	150	750000	0.075
Awareness sessions in the school for students and teachers on water auditing	500	4,000	2000000	0.20
Leadership training for community-based trainers	5,000	150	750000	0.075
Disaster-preparedness in sanitation for for community-based trainers	5,000	150	750000	0.075
Capacity Building Workshops				
Water resource management workshop for officials	8,000	60	480000	0.048
Sanitation system upgradation workshop for planners	8,000	50	400000	0.04
Public health awareness for community-based trainers	5,000	150	750000	0.075
Behaviour changes communication workshop for community-based trainers	5,000	150	750000	0.075
Development of Training Materials				
Manuals and guides	5,000	1000 set	5000000	0.50
E-learning modules for remote learning	300000	5 modules	1500000	0.15
Interactive mobile apps development for training purposes	600000	1	600000	0.06
Infrastructure Setup for Training				
Setting up of water quality testing centre	6000000	1	6000000	0.60
Chemicals and equipment used in testing centre	10,000,000	1	10000000	1
Training centre (rental) for 6 months	200,000	1	200000	0.02
Training equipment (audio-visual)	300000	1 set	300000	0.03
Accommodation for participants	5,000	1000	5000000	0.50
Transportation and accommodation Costs for trainers	50000	60	3000000	0.30
Monitoring & Evaluation				
Post-training assessments for evaluation of training impact	5,000	1000	5000000	0.50
Field visit for follow-up	8,000	10 visits	80000	0.008
Data collection and analysis for tracking progress	100,000	1	100000	0.01
Administrative Costs				
Reporting and Documentation			300000	0.03
IEC Materials (Print & Digital)			600000	0.06
Contingency (10%)			4546000	0.454
Total			**50006000**	**5.00**

visits to ensure the effectiveness of the training programs.

A portion of the amount is allocated for public awareness campaigns and information, education, and communication (IEC) materials. Furthermore, a 10% contingency is included to cover any unforeseen costs, ensuring that the recovery and capacity-building efforts are comprehensive and sustainable. The detailed cost estimate for training and capacity building is given in ***Table 7-14***.

Implementation Mechanism

The successful reconstruction and sustainable management of the new township in Meppadi Grama Panchayat hinge on a coordinated effort among several key departments. Each department will play a critical role in ensuring that the water supply and sanitation systems are not only restored but also upgraded to meet modern standards of efficiency and safety. The primary departments involved in this effort include the Kerala Water Authority (KWA), Suchitwa Mission, and the Local Self-Government Department (LSGD). The implementation mechanism is given in ***Figure 7-2***.

KWA will be responsible for the overall planning and design of the water supply scheme, ensuring that it aligns with the projected demand of up to 2 MLD. This includes the selection of appropriate technologies for water treatment and distribution to meet the needs of the township residents. KWA will oversee the construction and installation of the water treatment plant, pipelines, and associated infrastructure. In addition to the main water supply scheme, KWA will manage the implementation of the rainwater harvesting system.

This involves designing and constructing the harvesting structures, ensuring they are strategically placed to optimize water collection and storage throughout the township. Once the infrastructure is in place, KWA will be responsible for the ongoing operation and maintenance of both the water supply scheme and the rainwater harvesting system. This includes regular monitoring, maintenance of equipment, and prompt repair of any faults to ensure uninterrupted service.
The Suchitwa Mission will be tasked with overseeing the planning, construction, and maintenance of community toilets in the township. These facilities will cater to public amenities such as schools, government offices, parks, and cultural complexes, ensuring they are accessible, hygienic, and inclusive for all residents, including persons with disability and transgender.

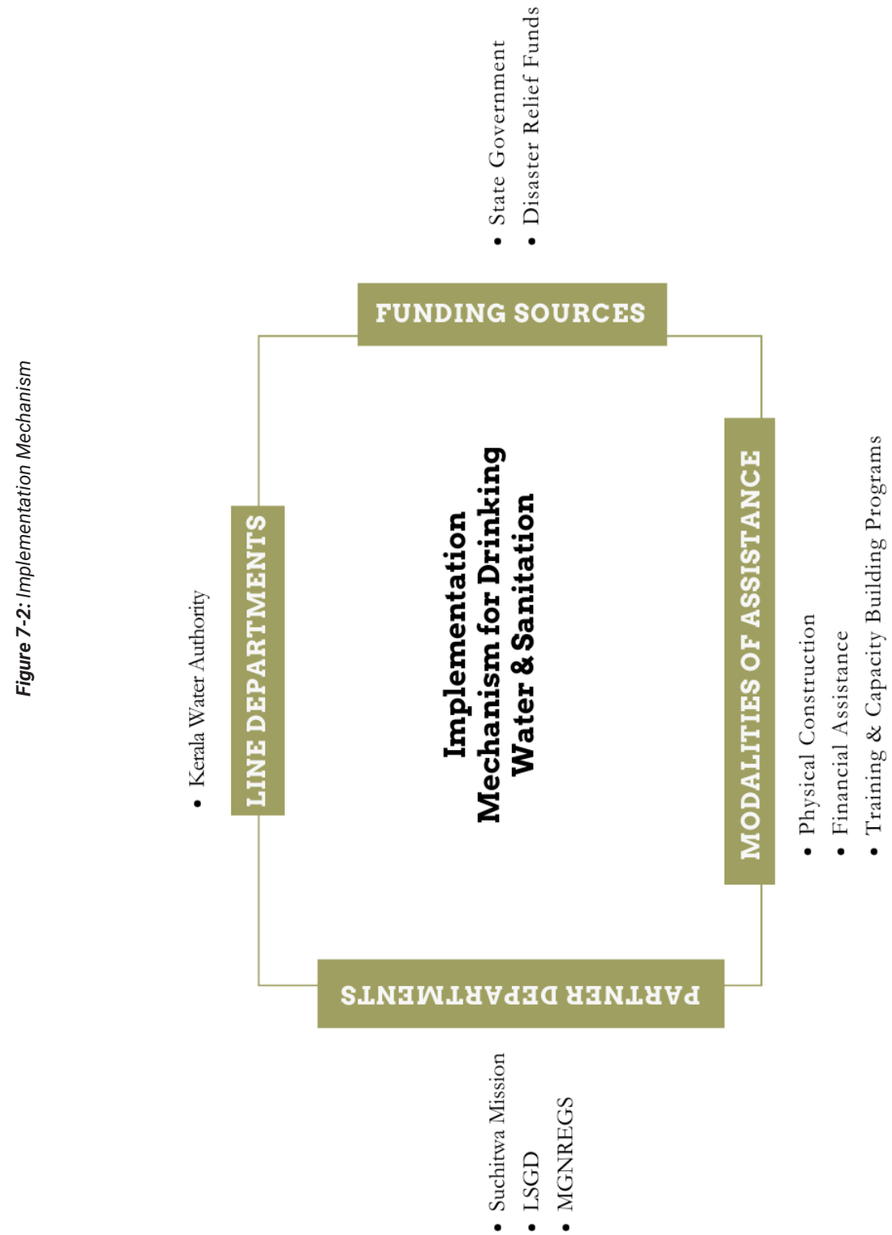
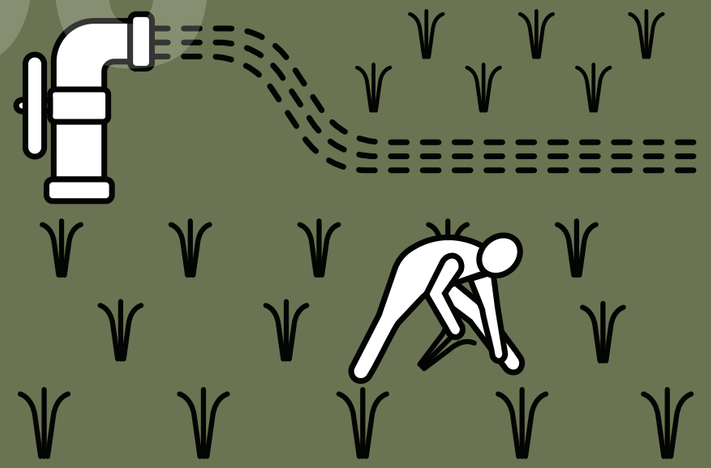


Figure 7-2: *Implementation Mechanism*



08



Irrigation

8.1. Basic Profile of the Sector

The irrigation sector in Kerala is a critical component of the state's water management infrastructure, playing a pivotal role in supporting agricultural productivity, managing flood risks, and preserving coastal and riverine ecosystems. Kerala's unique topography, with its extensive river systems, mountainous terrain, and coastline, makes the efficient management of water resources both complex and vital to the state's socio-economic stability.

Major and Minor Irrigation Projects

Kerala's irrigation infrastructure includes both large-scale and small-scale projects that serve the dual purpose of water supply and flood control. Major projects comprise large dams, reservoirs, and canal networks that distribute water to agricultural lands, especially during the dry seasons. These major irrigation systems are essential for the cultivation of water-intensive crops like paddy, which is central to Kerala's food security.

Minor irrigation projects, such as check dams, tanks, and rainwater harvesting structures, complement these larger systems. These smaller initiatives are particularly important in hilly areas like Wayanad and in regions that rely on decentralized water sources for agriculture. Together, these projects promote sustainable agricultural practices by ensuring a continuous supply of water for crops, improving farmer livelihoods, and contributing to the rural economy.

Inter-State Water Sharing

Kerala's rivers are also inter-state in nature, with several major rivers being shared with neighboring states. Water sharing agreements are crucial for maintaining equitable distribution of resources between states. These agreements

affect irrigation practices, water availability, and overall agricultural production. Ensuring compliance with inter-state water-sharing pacts is critical for the uninterrupted flow of water to Kerala's farmlands.

Flood Control

Kerala is highly vulnerable to seasonal flooding, especially during the southwest monsoon.

The irrigation sector plays a crucial role in flood control through the maintenance and management of reservoirs, embankments, and flood channels. Dams and reservoirs are operated to release water in a controlled manner, reducing downstream flood risks. Additionally, river dredging and bank protection works are carried out to improve water flow during high-rainfall events, safeguarding both urban and rural areas from the devastating impacts of floods.

Coastal Zone Management

Kerala is highly prone to coastal erosion and saltwater intrusion. The irrigation sector's involvement in coastal zone management is vital for protecting freshwater resources and maintaining agricultural lands near coastal areas. Irrigation structures help prevent seawater from contaminating inland water sources, ensuring that freshwater remains available for agricultural and drinking purposes. Measures like building groynes, sea walls, and bunds are commonly employed to protect the coastline from erosion and minimize the intrusion of saltwater.

Role of Rivers in Irrigation

Kerala's river systems are the life blood of its irrigation sector. Rivers like the Periyar, Punnapuzha, Bharathapuzha, Pampa, Iruvazhinji etc provide essential water for the state's agricultural activities. The Iruvazhinji River, for example, supports Wayanad's agricultural economy by providing irrigation for crops like coffee, cardamom, pepper, and tea. This river, like many others in Kerala, is not only an agricultural resource but also an ecological asset, contributing to the biodiversity of the region.

Iruvazhinji River (Punnapuzha)

The Iruvazhinji River (Punnapuzha) having approximate length of 50 km is a tributary of the Chaliyar River, originates in the Vellarimala hills of the Western Ghats. These steep, forested hills are a primary source of freshwater. Fed by heavy rainfall and high altitude, the Iruvazhinji River flows through Wayanad district, supporting its agriculture. The Iruvazhinji River plays a pivotal role in supporting the local economy by providing irrigation for tea estates, and spice plantations. These agricultural activities form the backbone of Wayanad's rural communities. The river's water is essential for cultivating crops like coffee, cardamom, pepper, and tea, which are renowned for their quality and contribute to the region's economic vitality.

Beyond its agricultural benefits, the Iruvazhinji River also serves as a crucial ecological resource. It contributes to the biodiversity of the Wayanad region, providing habitat for a diverse range of flora and fauna. The river's ecosystem supports aquatic life, including fish and amphibians, while its banks provide a suitable environment for various terrestrial species. The Iruvazhinji River eventually merges with the Chaliyar River near the village of Nilambur in Malappuram district. This confluence is significant as the Chaliyar River is one of Kerala's major rivers, ultimately draining into the Arabian Sea.

8.2. Sectoral Policies

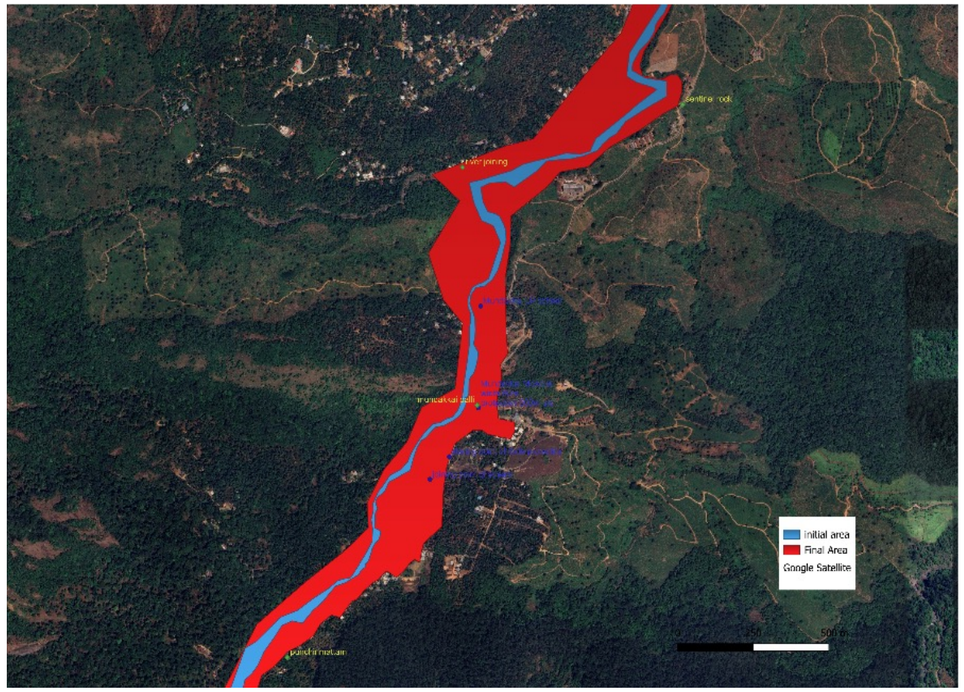
The Wayanad district has a unique agricultural landscape that relies heavily on irrigation.

The Water Resources Department of the Government of Kerala had published the Water Policy-2008 by which, the state shall follow the following priority for allocating water among the various categories of user. Such a prioritization will be primarily based on the integrity of Ecosystem and will also take into consideration the physical, environmental and social background of the state. The priority is as follows

- Domestic use
- Agricultural use
- Power Generation
- Agri-based industrial use
- Industrial and Commercial use
- All other uses

The district's irrigation policies are primarily designed to meet the demands of its diverse

Figure 8-1: *Area of river before and after landslide*



agricultural sector, which includes paddy cultivation, coffee plantations, and spice gardens. To enhance water availability and prevent soil erosion, the department has implemented various conservation measures. These include the construction of check dams, vented cross bars, lift irrigation schemes, ponds, and river training works. These initiatives not only facilitate agricultural activities but also contribute to the region's overall development and tourism potential.

8.3. Damages in the Irrigation Sector

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. Before the landslide, the total area of river and embankment was around 11 Hectares. After the landslide, the total area of the river and eroded embankment became around 75 Hectares.

Figure 8-1 shows the area of river before and after landslides.

The landslide introduced much debris, including soil, rocks, trees, and other materials, into the river channel. This debris acted as natural dams at certain points, obstructing the river's flow and causing water levels to rise. The subsequent failure of these natural dams led to catastrophic flooding downstream. Evidence of this damming phenomenon was observed at Punchirimattam and Mundakkai.

The force of the landslide altered the course of the river, diverting it into new channels and causing it to erode new pathways.

Figure 8-2 and ***Figure 8-3*** show the comparison of landslide affected areas before and after the landslide.The event resulted in a large amount of sediment and massive boulders entering the river, increasing the sediment load of the river. The depth of silt deposition varies from 1 m to as high as 5 m. This has led to the river becom-

Figure 8-2: *Comparison of landslide affected area before and after landslide*



Sources: Google © 2024 Maxar Technologies, Airbus (before landslide); REUTERS/Francis Mascarenhas (after landslide)

ing shallower and increased the flow rate and flooding. Flash floods occurred downstream of the river, causing devastating damage to life and property.

Many huge boulders had eroded and deposited downstream of the river, as shown in Figure 8 4. The size, weight, and speed of the boulders made them a formidable force of nature as they tumbled down the slopes, crushing buildings, uprooting trees, and blocking roads, causing widespread destruction.

The impact of these boulders was so severe that it was often impossible for rescue teams to navigate the affected areas.The height of the boulders varies from 1 meter to as high as 7 meters and can be seen in ***Figure 8-5.***

The accumulation of sediments in the houses of Chooralmala, combined with the impact of massive boulders and uprooted, trees has wreaked havoc on the human habitation at Chooralmala and Mundakkai. The access to the habitation was also blocked by the sediment deposition, making it difficult for relief operations. In addition to human habitation, the sedimentation has also affected the overall biodiversity of the river ecosystem.

The damage to the river and its embankment was very severe. The damage was observed mainly in two forms.



Figure 8-3: *Satellite image comparisons of landslide affected areas obtained from NRSC*

Figure 8-4: *Huge boulders deposited after the landslide*





Figure 8-5: *Picture of the boulder with a person of height 170cm standing near for scale.*

Figure 8-6: *Satellite images before and after the landslide. Sources: Planet Labs (after landslide); Google © 2024 Maxar Technologies, Airbus (before landslide)*



Figure 8-7: *Silt Deposition in the river*

Erosion of River Embankment

One of the most immediate and visible effects of the landslide was the severe erosion of river embankments, as shown in ***Figure 8-6***. The landslide debris, including boulders, trees, and soil, was swept into the river channels, creating a powerful current that undermined the stability of the embankments. This erosion led to the collapse of sections of the embankments, widening the river channels and increasing the risk of flooding.

Sedimentation and Water Quality

The landslide also resulted in a significant increase in sedimentation in the river channels. The debris from the landslide, including soil, rocks, and organic matter, was carried downstream and deposited in the riverbeds as shown in ***Figure 8-7***.

This sedimentation had several negative consequences:

Reduced Water Flow:
The accumulation of sediment in the riverbeds has reduced the capacity of the river, leading to flooding in the river embankment. The bed of the river has been raised by an average height of 3 m due to the deposition of silt along the river.

Water Quality Issues:

The increased sediment load in the river water has reduced water quality, making it unsuitable for drinking, irrigation, or other uses. The sewage effluents from broken septic tanks and waste pits have added to the contamination of the river. The influx of sediment has increased the turbidity of the water, affecting aquatic life in the river.

8.4. Damages to Irrigation Structures and Equipment

The department had constructed a reinforced cement concrete protection wall of height 4.5 m downstream of the Chooralmala bridge in the year 2022. The structure has withstood the scouring effects of the landslide. The protection wall proved to be vital in the relief operations as a temporary walkway was setup over this protection wall to allow people to cross the river during the emergency relief operations, as shown in ***Figure 8-8***. A part of the structure was damaged due to the impact of the landslide debris.

The residents of Punchirimattam, Mundakkai, and Chooralmala rely on the Iruvazhinji River for their irrigation needs. Many of them use personal or rented pump sets to draw water for their agricultural activities. However, the landslide damaged a significant number of these pump sets, which will likely impact future agri-



Figure 8-8: *Protection wall before and after landslide*

Table 8-1: *Estimated Overall Irrigation Sector Damage Costs*

Name of the Irrigation Facility	Partially damaged (meters)	Totally damaged	Damage Cost (INR per meter)	Total Damage Estimate (Cr.)
Chooralmala RCC Side Protection Wall	33.16m		24,126	0.08
Pump Equipment and pipeline for agriculture		200 each	20,000	0.4
Total Amount				**0.48**

cultural productivity in the region.The damages are quantified as follows [***Table 8-1***]:

8.5. Economic Losses in the Sector

The tourism industry serves as the primary economic driver in Wayanad District. The Karapuzha Dam, a popular tourist destination offering stunning views of the reservoir and a range of adventurous activities, was significantly impacted by the landslide. Due to the closure of ghat roads, which provide the primary access to Wayanad, vehicles and machinery were brought in from various routes. Consequently, tourist activities at the Karapuzha Dam were curtailed, leading to a decline in tourism revenue.

A comparison of the revenue earned from entry tickets of Karapuzha dam between August 2023 and August 2024 is as follows [***Table 8-2***].

The data indicates that the landslide resulted in a loss of INR 17,68,660 in ticket sales alone. This suggests that a significant number of tourists were unable to visit the dam due to the closure of roads and the disruption of transportation services. The Karapuzha Dam is a popular destination for adventure activities as well. The closure of roads and the general disruption caused by the landslide led to a significant reduction in these activities.

As a result, the revenue earned from adventure activities declined from INR 45,21,870 in July 2024 to INR 7,75,830 in August 2024, representing a loss of INR 37,46,040. The combined loss of ticket revenue and revenue from adventure activities is INR 55,14,700. This trend of loss is expected to last for another few months until the economic recovery takes hold.

Socio-Economic Impact on People

The erosion of the river embankment and lack of access to the farmlands after the landslide have brought the agricultural activities on 626 hectares of land to a halt. This has affected the cultivation and harvesting activities of farmers in the landslide affected area. People who draw water from the river for their small cultivation lands also suffered damages due to the loss of pump sets and other agricultural equipment.

It is estimated that around 200 such pump sets were lost in the landslide.

Category	Ticket loss	Revenue loss	Total loss
Karapuzha Mega Tourism Project	0.177	0.375	0.55

Table 8-3: *Estimated Overall Economic Losses*

Category	Damage Estimate	Loss Estimate	Damage + Loss Estimate
Irrigation sector	0.48	0.55	1.03

Table 8-4: *Irrigation Sector Damage and Losses Components*

Table 8-2: Karapuzha Mega Tourism Project Revenue Earned through Entry Tickets

Karapuzha Mega Tourism Project Revenue Earned through Entry Tickets			
August - 2023		August – 2024	
Date	Amount (INR)	Date	Amount (Rs)
01-08-2023	14,240.00	01-08-2024	Closed due to Disaster
02-08-2023	15,950.00	02-08-2024	
03-08-2023	16,950.00	03-08-2024	
04-08-2023	20,050.00	04-08-2024	
05-08-2023	62,050.00	05-08-2024	
06-08-2023	87,330.00	06-08-2024	
07-08-2023	24,000.00	07-08-2024	
08-08-2023	18,180.00	08-08-2024	
09-08-2023	23,440.00	09-08-2024	
10-08-2023	19,750.00	10-08-2024	
11-08-2023	20,480.00	11-08-2024	
12-08-2023	1,25,190.00	12-08-2024	
13-08-2023	2,01,620.00	13-08-2024	
14-08-2023	1,04,060.00	14-08-2024	
15-08-2023	62,300.00	15-08-2024	6,700.00
16-08-2023	18,770.00	16-08-2024	13,870.00
17-08-2023	21,610.00	17-08-2024	15,600.00
18-08-2023	19,310.00	18-08-2024	17,560.00
19-08-2023	27,450.00	19-08-2024	7,760.00
20-08-2023	62,820.00	20-08-2024	10,410.00
21-08-2023	14,110.00	21-08-2024	2,630.00
22-08-2023	12,850.00	22-08-2024	4,760.00
23-08-2023	13,220.00	23-08-2024	6,120.00
24-08-2023	17,440.00	24-08-2024	10,120.00
25-08-2023	24,120.00	25-08-2024	25,440.00
26-08-2023	43,500.00	26-08-2024	20,180.00
27-08-2023	1,03,610.00	27-08-2024	5,250.00
28-08-2023	78,410.00	28-08-2024	12,640.00
29-08-2023	1,37,040.00	29-08-2024	3310.00
30-08-2023	2,51,330.00	30-08-2024	
31-08-2023	2,69,830.00	31-08-2024	
Total	**INR. 19,31,010.00**	**Total**	**INR.1,62,350.00**

8.6. Response by the Government

To mitigate the risk of flooding and improve water flow, the Kerala government deployed machinery to clear the landslide debris from these areas. Additionally, blocked small streams were cleared to prevent further flooding. Caution tapes were placed near eroded embankments with nearby access ways to alert people of the potential dangers and prevent accidents.

8.7. Reconstruction and Recovery Needs Assessment

The Meppadi landslide tragically underscored the need for a more sustainable and resilient development model. The extensive loss of life and infrastructure highlighted the vulnerabilities of the region's current settlement patterns. To prevent future disasters and ensure the safety and wellbeing of residents, it is essential to adopt settlement patterns that minimize environmental impacts. Homestead style settlements, which combine residential and agricultural uses, are particularly well-suited for Wayanad's agro-based economy.

A decentralized settlement model with terraced farming practices is well-suited to Wayanad's hilly terrain. This approach encourages independence while fostering a strong sense of community through shared facilities. The terraced structure with retaining walls made of local materials follows the natural contours of the hills, allowing for efficient farming and easy access to farmland.

The agriculture and tourism sectors are the driving forces of the economy of Wayanad District. The residents of the affected area were mostly into the cultivation of cash crops such as coffee, cardamom, tea, coconut, areca nuts, etc. It is assumed that they will continue doing the same agricultural practices in the new area allotted to them.

A community micro irrigation program will ensure maximum benefits at optimum utilization of water sources without affecting the environment. Using this system, it is possible to provide irrigation facilities to cash crops to enhance the production and income of farmers. Also, equitable distribution of irrigation water from head to tail in the command area can be assured.

Given the changing rainfall patterns in Wayanad due to climate change, the Karapuzha Reservoir presents a reliable water source for community micro irrigation. While small water conservation structures can be useful, they may not meet water demands during dry seasons. Therefore, it's proposed to connect these structures to the Karapuzha Reservoir for regular replenishment. The proposed system involves pumping water from the Karapuzha reservoir to a filtration tank and then distributing it to individual plots through a network of pipes. A fertigation system will allow for the precise application of fertilizers and nutrients. The system will be fully automated, controlled by a central unit, and equipped with automated valves to ensure proper water distribution. The key components of the Community Micro Irrigation Project are the irrigation tank, main line, submain line, drip manifold, primary and secondary filter units, fertilization unit, and control unit.

Additionally, water conservation structures like check dams and ponds will be implemented. Contour bunding and tree planting will also be considered to conserve water and reduce surface runoff.

An automated weather station (AWS) would be an asset for the proposed township, particularly given the region's vulnerability to landslides and other weather related events.

This would be helpful in the collection and monitoring of long-term climate data, which is essential for understanding local weather patterns and predicting future trends. This data can be used for various research purposes, such as agricultural planning, disaster management, and climate change studies. It can be used to disseminate weather information to the public, increasing awareness and preparedness.

8.8. Reconstruction Cost Estimates

The reconstruction activities involve all activities done for the proposed township. Two two-storeyed pumphouses of plan dimensions 15m X 6m and an intake structure of diameter 6 m and height 18 m shall be constructed to pump water from the Karapuzha reservoir to a cistern in the proposed township. Assuming 15 km distance from Karapuzha Reservoir to the township.

The total area allocated for the township is 356 acres. Out of this, 50% (178 acres) is designated for agriculture, referred to as Area A1. Assuming that each household in the township is allocated 10 cents of land, with 5 cents designated for vegetation and gardening, and considering there are 2,000 households, this accounts for 100 acres, referred to as Area A2. Therefore, the total irrigated area is 278 acres or 27,800 cents. The water drainage network shall be idealized as concrete drains of 2000-meter length draining the storm water to 3 collection ponds at a lower level. A check dam of 8m long and 1.5m high with concrete side protection walls of 80 m on both sides of the embankment will be constructed to ensure good availability of water near the pumphouse.

The estimates for the same are as follows:

Table 8-5: *Reconstruction Cost Detailed Estimate*

Sl. No	Category	Quantity	Unit Cost (INR)	Cost Estimate (INR)	Total Cost (In Cr.)
1	Cost of pumphouse building including intake structure and cistern for conveyance of Water from Karapuzha Reservoir to Township				
	Cost of Two-Storey pumphouse building(15mx6mx2m) – 2 No	360 m^2	25,500 x 1.36	1,24,84,800	1.25
	Cost of Intake structure	364 m^2	25,500 x 1.36	1,26,23,520	1.26
	Cost of Cistern	302 m^2	25,500 x 1.36	1,04,73,360	1.05
2	Cost of pump sets and pipeline network for conveyance of water from Karapuzha Reservoir to a cistern in the Township				
	Cost of ductile iron pipeline of minimum 300 mm diameter	15 km	90,00,000	13,50,00,000	13.5
	Cost of 120HP pump set including starter	3 No	19,00,000	57,00,000	0.57
	Cost of 100HP pump set including starter	3 No	15,00,000	45,00,000	0.45
	Cost of 10HP vacuum pump set including starter	2 No	2,50,000	5,00,000	0.05
	Road Cutting charges for laying pipeline			5,00,000	0.05
	Charges to be paid to Kerala State Electricity Board for setting up of transformer yard, Electricity Line Extension			60,00,000	0.6
	Charges to be paid to Kerala State Electricity Board as Caution Deposit, Connection charges			15,00,000	0.15
	18% GST and provision for unforeseen circumstances			2,80,00,000	2.80
3	Cost of Implementing Community Micro Irrigation	27800 cents	2,000	5,56,00,000	5.56
4	Drainage Network and Water Conservation				
	Cost of drainage channel of length 2000m	2000 m	6,822	1,36,44,000	1.36
	Cost of collection pond of size 20m X 30m	600 m^2	12,800	76,80,000	0.77
	Cost of collection pond of size 50m X 50m	2500 m^2	5,664	1,41,60,000	1.42
5	Cost of Check Dam at Township				
	Cost of 8m long Check dam with a weir body of height 1.5m	1 No	26,00,000	26,00,000	0.26
	Cost of concrete side protection works of height 2m and length 160m for the proposed check dam	160 m	33,550	53,68,000	0.54
	Add GST for construction of check dam and protection wall@ 18%			14,34,240	0.14
6	Contour Terracing in Township -Cost of 3000m of dry rubble side protection walls of height 1.5m along the edge of the terrace	3000m	7,000	2,10,00,000	2.1
	Unforeseen Items				0.12
	Total				**34**

The estimate for reconstruction can be summarised as follows [***Table 8-6***]:

8.9. Recovery Cost

The recovery cost estimate in the irrigation sector comes to INR 2.62 Cr. This comprehensive estimate includes the installation of 5 river gauges at key locations to improve real-time flood monitoring, with provisions for their maintenance for 5 years. Advanced flood modelling software will be procured to enhance the region's ability to predict and manage flood risks. Training programs will be provided for engineers, officials, and technical staff in flood risk assessment, river gauge operations, and flood modeling, while community leaders will be trained in flood risk reduction at the community level. Capacity-building workshops will focus on river basin management and early warning systems, equipping local personnel with essential skills. Infrastructure for these programs includes renting training centres and accommodation for participants.

Additionally, post-training assessments, field visits, and monitoring systems will be put in place to evaluate the success of the initiatives. Public awareness campaigns, educational materials, and a 10% contingency fund to address unforeseen expenses are also part of the estimate. This recovery plan aims to enhance the resilience of irrigation sector to future flood risks.

Category	Cost	Timeline
Cost of pumphouse building including intake structure and cistern	3.56 Cr.	12 Months
Cost of pump sets and pipeline network for conveyance of water from Karapuzha Reservoir to a cistern in the Township	18.17 Cr.	12 Months
Cost of Community Micro Irrigation Project	5.56 Cr.	12 Months
Cost of Drainage Network and Water Conservation	3.55 Cr.	12 Months
Cost of Check Dam at Township	0.94 Cr.	12 Months
Cost of Contour Terracing	2.10 Cr.	12 Months
Unforeseen Items	0.12 Cr.	
Total amount	**34.00 Cr.**	

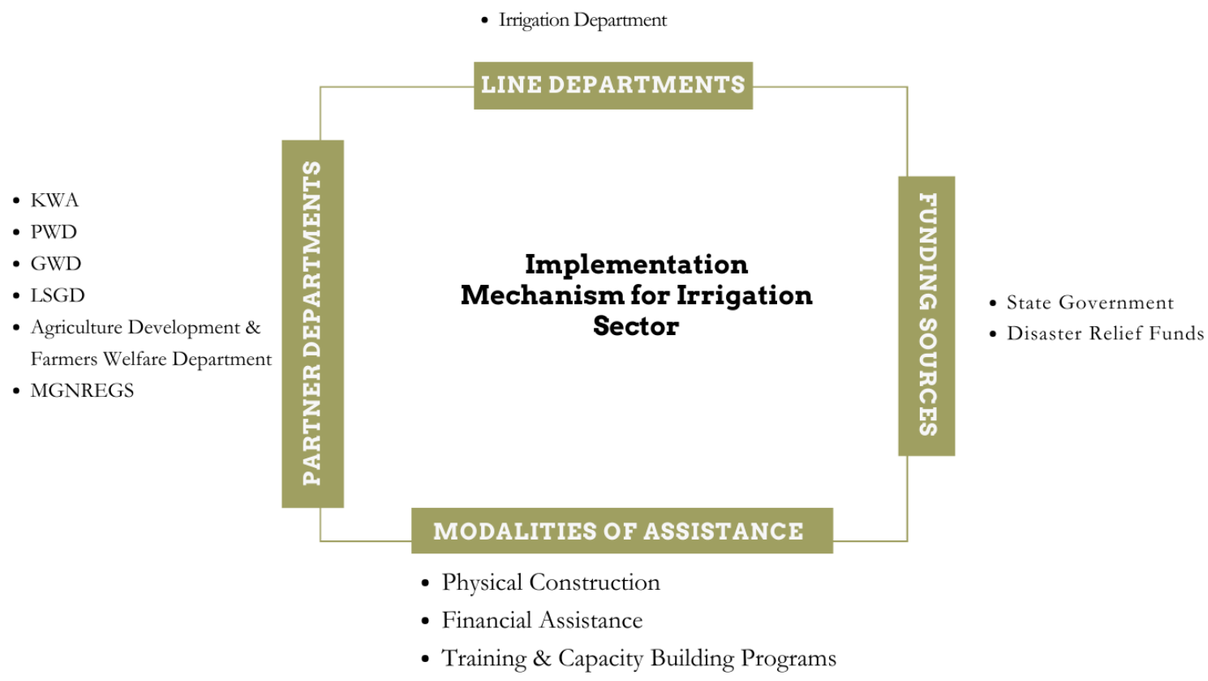
Table 8-6: *Summary of Reconstruction Cost Estimate*

Table 8-7: *Cost estimate for training and capacity building*

Sl. No	Components	Cost per Unit in INR	Nos	Amount in (INR.)	Amount in Cr.
1	River Gauges Installation				
	Procurement of river gauges	500,000	5	2500000	0.25
	Installation & calibration in key river sites	100,000	5	500000	0.05
	Annual maintenance & support	50,000	5x5 years	1250000	0.125
2	Flood Modeling Software				
	Procurement of flood modeling software and advanced flood simulation tools	1,500,000	1 license	1,500,000	0.15
	Software setup & integration	300,000	1	300000	0.03
	Annual software maintenance and license renewal	200,000	5 years	1000000	0.10
3	Training Programs				
	Flood risk assessment training for engineers and officials	8,000	100	800,000	0.08
	River gauge operation & maintenance training for technical staff	5,000	100	500,000	0.05
	Flood modeling & simulation training for engineers	8,000	50	400,000	0.04
	Community-based flood risk reduction training for community - based trainers	5,000	150	750000	0.075

4	**Capacity Building Workshops**				
	River basin management workshop for engineers and planners	8,000	100	800,000	0.08
	Flood early warning system workshop for irrigation officials	8,000	50	400,000	0.04
5	Development of Training Materials				
	Manuals and guides	5,000	600 set	3000000	0.30
	E-learning modules for remote learning	300000	3 modules	900000	0.09
	Interactive mobile apps development for training purposes	600000	1	600000	0.06
6	Infrastructure Setup for Training				
	Training center (rental) for 6 months	200,000	1	200000	0.02
	Training equipment (audio-visual)	300000	1 set	300000	0.03
	Accommodation for Participants	5,000	500	2500000	0.25
	Transportation and accommodation Costs for trainers	50000	30	1500000	0.15
7	Monitoring & Evaluation				
	Post-training assessments for evaluation of training impact	5,000	600	3000000	0.30
	Field visit for follow-up	8,000	10 visits	80000	0.008
	Data collection and analysis for tracking progress	100,000	1	100000	0.01
8	Administrative Costs				
	Reporting and Documentation			300000	0.03
	IEC Materials (Print & Digital)			600000	0.06
9	Contingency (10%)			2378000	0.24
	Total			**26158000**	**2.62**

***Figure 8-9:**,Implementation Mechanism for irrigation sector*





09



Roads and Bridges

9.1. Basic Profile of the Sector

Meppadi Grama Panchayat in Vythiri Taluk, Wayanad district, was beset by a deadly landslide that resulted in a flow of mud and debris in the early hours of July 30, 2024, and was subsequently declared a disaster by the G.O.(P) No.1/2024/DMD Dated 02-08-2024. The landslide is expected to be 86,000 square metres in total, with a length of 8 kilometres. As of now, 251 people have died and 47 people are still missing. The current PDNA is an attempt to assess the reported damages and losses to the road and bridge infrastructure in the disaster affected region.

A temporary Bailey bridge has been constructed in Chooralmala by the Indian Army and is supported by PWD. For constructing a new bridge at this location and for connecting it with SH 29 it will take another 24-36 months. The total damages and losses to the road and bridge sector (managed by PWD and LSGD) in the disaster affected area is estimated to be INR 30.41 Cr with an estimate of INR 28.41 Cr for damages and INR 2 Cr for losses.

The short, medium and long-term recovery and reconstruction cost is estimated as INR 267.62 Cr. The reconstruction of roads and culverts can be completed in the short term while the construction of new bridges, resilience enhancement of SH-29 (Meppadi- Chooralmala connector), one helipad, approach roads and internal roads in township can be completed in the medium to long term.

Table 9-1: *Total Damages, Losses, Reconstruction And Recovery Estimates (In INR Cr.)*

Disaster Location	Damages (Cr.)	Losses (Cr.)	Damages + Losses (Cr.)	Reconstruction Needs (Cr.)	Recovery Needs (Cr.)	Reconstruction + Recovery Needs (Cr.)
Meppdi Grama Panchayat, Wayanad	28.41	2	30.41	96.77	170.85	267.62

The transport sector is critical for any state's economic and social wellbeing. All the key economic and livelihood activities, such as tourism, agriculture, horticulture, mining, and forestry, depend on a sound and connected transportation network. Social well-being aspects such as access to education and health are also dependent on mobility. In that context, Kerala is quite advanced, having the highest road density in India among major states (barring union territories). Road dominates both passenger and freight traffic, with railways playing a marginal role in Kerala.

In the total 2.7 lakhs km of road networks in the State, primary road network carries about 80 percent of road traffic and the mainstay of economic activities, and includes about 1,782 km of National Highways (NH), and about 31,812 km of State Highways (SH) and Major District Roads (MDR).

Kerala's SH and MDR networks are managed by the Roads and Bridges (R&B) wings of the Public Works Department (PWD) whereas rural road networks (around 75%) are managed by the Local Self Government Department (LSGD).

In the light of climate change, development and management of the road network following low-carbon and resilient planning approaches have emerged as key needs for Kerala and its

Name of the Department	Length (Km)	Percentage (%)
Panchayats (LSGDs)	2,06,620.23	75.65
PWD (Roads & Bridges)	31,812.10	11.65
Municipalities	18,411.87	6.74
Corporations	6,644.00	2.43
Forests	4,903.64	1.80
Irrigation	2,611.90	0.96
PWD (NH)	1,781.57	0.65
Others (Railways, KSEB etc.)	328.00	0.12
Total	**2,73,113.30**	**100.00**
[Source: Economic Review 2019, Kerala State Planning Board]		

Table 9-2: *Department wise distribution of roads in Kerala in 2018-19*

citizens. Post-2018 floods, low-carbon and resilient development is also firmly embedded in PWD's vision for road development, with various pilot project implementations under the flagship Resilient Kerala Program, which is expected to be mainstreamed in PWD.

The roads not only provide social and economic connectivity but are important from the standpoint of community evacuation in the event of any disaster. And thus, there is a need for adequate service resilience, and more particularly in the case of hills where alternate road networks may not be available. Thus, while PWD's focus in resilient road planning is predominantly aimed at highly trafficked SH and MDR networks, which provide a higher economic cost-benefit ratio, interventions towards resilience of even some low-trafficked roads and rural roads in hills not connected by alternate roads are emerging as a critical need in areas with disaster risks.

The recent landslide in Puthumala (which killed 17 people in 2019 and destroyed several houses) and Chooralmala (2024, for which the current PDNA exercise is being undertaken) in Meppadi area faces significant landslide risks, hence requires proper mitigation measures against climate and disaster risks and also serviceability for evacuation of affected people.

9.2. Sectoral Policies

There are several investment programs in the road sector i.e., capital and maintenance works for SHs and MDRs covered under PWD budget; hill & coastal Highways program, SH & MDR reconstruction and rehabilitation program with funding support of KIIFB; reconstruction and rehabilitation of SH, MDR and village roads under Resilient Kerala Initiative (RKI) applying green, resilient and sustainable construction methodologies. Several rural roads programs are also implemented by LSGD including PMGSY. The strategic directions of investment programs in road sector are driven by:

- **State Road Sector Policy (GO (MS) No. 5/06/PWD dated 18.1.2006):** It sets a strategic direction for the sector, giving priority to aspects of road network planning, safety and efficiency, construction and upgradation standards, road administration, and funding; Task force draft of Kerala Road Development Policy 2009-21 (GO (Rt) No.1718/08/PWD dated Thiruvananthapuram, 15/10/2008) supports thematic areas of adopting better standards and specifications in road design and construction.

- **PWD Manual (Revised 2012):** The PWD Manual, drafted in 2012 has taken due cognizance of several thematic areas that remain relevant even in today's context i.e. design and construction practices, road safety, regular review of roads and bridges, road asset management.

- **PWD Laboratory Manual (2015), PWD Quality Control Manual (2015; updated in 2016) along with updated IS and IRC codes:** Guides quality assurance of civil works.

- **Roads and Bridges Maintenance Policy (2016):** It is aimed at standardising maintenance prioritisation and implementation process which is critical to enhance climate resilience of the assets. The Road Maintenance Wing (RM Wing), was envisaged under Road Maintenance Policy 2016.

- **Climate Informed Road Maintenance and Management System (RMMS) for core road network (CRN):** PWD had scientifically identified and notified, around 7000 km of Core Road Network (CRN), vide the Government Order G.O. (P) No. 1/2020/PWD dated April 7, 2020. With the support of World Bank, KSTP and Resilient Kerala Program, a climate informed Road Maintenance and Management System (RMMS) for CRN was developed in 2020-21. RMMS is currently hosted in the KSTP and PWD has recently reconstituted RMMS Cell through G.O. (RI) No. 174/2024/PWD dated 12-02-2024 for managing the same with integration and updation of flood and landslide hazard maps from KSDMA.

- PWD has also embraced the long-term Output and Performance Based Road maintenance contracting model (OPBRC, 7 years contracts) along with adoption of a state-specific standard bidding document. OPBRC incorporates climate works and disaster related emergency response modules. This new contracting model is aimed at the Core Road Network (CRN) facing higher disaster and climate risks. So far, around 4 OPBRC contracts have been awarded since its launch in 2020.

- PWD is also in the process of developing a climate risk and vulnerability assessment guideline and local standard for climate resilience planning (engineering and non-engineering interventions) for road development. A study to undertake pilot value engineering interventions in road construction is also under progress. Currently, both of these studies are being undertaken under KfW (German Bank supported) Resilient Kerala Initiative funded Technical Assistance (TA).

- **Quality Assurance Handbook for Resilient Reconstruction of Flood Damaged Rural Roads 2020:** LSGDs in Kerala have emerged as effective agencies for the implementation of developmental programs and responsible for maintenance of rural & urban roads and other civil assets within their respective jurisdictional areas. This guideline is to enable sustainable and resilient LSGD roads and allied structures that are scientifically designed as well as ecologically friendly, for improved productivity and economic efficiency of transport that will act as catalyst to the overall development of the State of Kerala.

9.3. Damages in the Sector

Diagnostic of Natural Hazard and Climate Change Risks

The whole of western Kerala, is a hilly terrain forming part of western ghats with steep slopes and susceptible to landslides triggered by high intensity of rainfall. In 2018 Kerala floods, around 4728 landslides of different intensity had occurred. The state was again hit by a series of landslides in 2019 resulting in the loss of 125 lives. On 6th August 2020, 70 people died in Pettimudi, Idukki owing to landslides. On 16th October 2021, in Kanjirappally Taluk of Kottayam district alone about 23 landslide events were recorded.

As per landslide atlas released by the Indian Space Research Organisation's (ISRO) National Remote Sensing Centre in 2023, 10 out of the 30 most landslide-prone districts in India are located in Kerala, with Wayanad ranked 13th.

The terrain has two distinctive layers, a layer of soil sitting atop hard rocks. During high intensity rainfalls continuously for days, the soil gets saturated with moisture and water reaches the rocks and flows between the soil and the rock layer. This weakens the force binding of the soil to the rocks and triggers the landslide movements.

A 2021 study on landslide hotspots in India revealed that 59 per cent of the total landslides in Kerala occurred in plantation areas. Climate scientists have pointed towards the warming of the Arabian Sea as one of the causes for the extremely heavy and unpredictable rain patterns in the state which are the main triggers for landslides.

The massive landslide that hit the hilly areas of Chooralmala and Mundakkai is situated in Meppadi Grama Panchayat (Ward numbers 10,11 and 12) in Kerala's Wayanad district. It is estimated to have impacted 86,000 sq. m and length of 8 kms killing 251 people, 47 still missing and dislodging a large public and private infrastructure.

The disaster location and Meppadi Grama Panchayat is located in a fragile ecology with land use that is a mix of tea coffee and spice plantation, local people, plantation workers and also have significant tourist footfall. Meppadi has witnessed a history of landslides, disasters, debris and mudflow triggered in the last 5 years with a landslide and mudflow at Puttumala that killed 17 people with several houses damaged which is around 5 km from the current disaster location.

The only connecting road to Chooralmala is the Meppadi-Road (SH-59) having a total length of 12.4 km. This road is being upgraded to a road with 7.5 m carriageway, adequate pavement design, culverts and provision of hill side drains along the alignment. Some dry rubble protection works adjoining the slab culvert at Puttumala landslide disaster site were found to be under construction.This road needs to maintain adequate level of serviceability even in the event of disaster as this is the only connector road to the high-risk upper hill towns of Chooralmala, Attamala, Mundakkai dotted with tea estates and plantations and points of tourist attractions.

Figure 9-1: *Map showing damaged road assets in landslide affected areas*



Damage Assessment Approach

Field visit by sector PDNA team (comprising NDMA, KSDMA and PWD Engineers) was conducted to assess the nature of damages that the road infrastructure in Chooralmala, Mundakkai faced and accordingly the data were categorised for estimation of damage and loss. The road and bridge infrastructure damaged were primarily village roads managed by PWD and LSGD. Now, Govt. of Kerala (GoK) has mandated PWD to carry out the immediate and long-term recovery of the road infrastructure in disaster-impacted areas.

A total of 13.1 km of rural roads, 1 km of state highway, 1 pedestrian bridge and 3 road bridges over rivers were washed away along with 7 culverts which got fully damaged. A bailey bridge has been constructed at Chooralmala to connect to the other side of the river.

Summary of damage category classification

- **Totally Damaged/Washed away:**
  The roads, bridges, and culverts were either washed away, or damaged to the level owing to flood, mud and debris flow. Here the entire asset has to be reconstructed considering HFL, river side protection, hill side drains, additional cross drainage structures and breast walls with gabions preferably.

- **Severely Damaged:**
  Roads with major segments damaged, or significant damage to retaining and breast walls, crust damages, potholes, damage to drainage. The repair cost can be estimated to be between 70% of the total replacement



Figure 9-2: *Location of bridge near to school at Mundakkai*



Major Sita Ashok Shelke, the sole woman officer in the Indian Army's Madras Engineering Group, successfully oversaw the construction of Cl 24 Bailey Bridge in record time (The landslide completely washed away the bridge connecting Chooralmala and Mundakkai over the Iruvanipzha River, leaving no trace behind).

Figure 9-3: *Bailey bridge constructed at Chooralmala by Army*



cost and the need for hill side drains, breast and retaining walls with wire crate gabions.

- **Partially Damaged:**
  Crust damaged, potholes, damage to drainage etc. Here the cost of repair can be estimated to be < 30% of total replacement cost.

- **Loss estimate:**
  The cost of temporary Bailey bridges, deployment of additional machinery & temporary setups made for the removal of debris.

For damage assessment, unit rates for various items have been worked out based on the DSR Schedule of Rates 2018 applying a cost index of 36.44% to arrive at the current rates for Wayanad District.

For the cost of reconstruction & recovery costs, the unit prices for various items of works which also include resilient work items have been calculated based on the DSR Rates 2018 applying cost index of 36.44% to arrive at the current rates for Wayanad District and thereafter an escalation factor of 20% has been added to arrive at the market rates.

Damage Assessment Results

(Refer ***Table 9-3, 9-4 & 9-5***)

The average repair cost for 3.5 and 3.8 m width carriageways is INR 1.04 Cr. and INR1.05 Cr. per km for bituminous roads respectively.

Economic Losses in The Sector

Total losses sustained by the road sector INR 2 Cr., on account of expenses related to debris removal from roads, post disaster bailey bridge installation at Chooralmala to establish connectivity to Mundakkai and strengthening of its foundation. This loss estimate has been provided by PWD engineer. The expenses towards other debris removal (boulders and rocks) from the river and streams shall be covered under water resources and irrigation sector of the report and is based on certain technical studies being commissioned by GoK. While these direct losses are incurred by the road sector, the other sectors dependent on road connectivity such as tourism, horticulture, plantations, local MSMEs have disruptions to their livelihood and business income.

The individual sectors have also accounted for these losses as part of this PDNA.

Table 9-3: *Road Sector Damage in Meppadi G.P. (Numbers)*

Asset Type	Totally Damaged	Severely Damaged	Partially Damaged	Total
Roads	km	km	km	km
Black Top	7.97	1.7	1.45	11.12
Cement	3.03			3.03
Total Road (in Km)	11.00	1.70	1.45	14.15
Bridges and Structures				
Minor Bridges (Nos.)	3	0	0	3
Pedestrian Bridge (Nos.)	1	0	0	1
RCC Box Culverts (Nos.)	7	0	0	7
Retaining wall (length in m)	100			100

Asset Type	Totally Damaged	Severely Damaged	Partially Damaged	Total
Roads	**INR Cr.**			
Black Top	12.3	2.17	1.51	15.98
Cement	5.91	0.00	0.00	5.91
Sub Total (Roads)	**18.21**	**2.17**	**1.51**	**21.89**
Bridges and Structures	**INR Cr.**			
Minor Bridges (Nos.)	5.07	0	0	5.07
Pedestrian Bridge (Nos.)	0.15	0	0	0.15
RCC Box Culverts (Nos.)	0.43	0	0	0.43
Retaining wall (length in m)	0.87	0	0	0.87
Sub Total (Bridges)	**6.52**	**0**	**0**	**6.52**
Total (Roads and Bridges)	**24.73**	**2.17**	**1.51**	**28.41**

Table 9-4: *Road Sector Damage In Meppadi G.P. (INR Cr.)*

Type of Roads	Average Replacement Cost		Average Major Repair Cost	
	3.5 m c/w*	3.8 m c/w	3.5 m c/w	3.8 m c/w
	(INR Cr./km)		(INR Cr./km)	
Black Top	1.5364	1.5877	1.2683	1.2967
Cement	1.9515		NA	
Road Bridges/ Structures	**(Cr./sq. m.)**		**(Cr./sq. m.)**	
Minor Bridge	0.0106	0.0106	Not Applicable Not Applicable	
RCC Box Culverts	0.0051	0.0051		
New Bridges (12 m)	**4.11**			
Pedestrian Bridges	**(Cr./m) ***			
Pedestrian Bridge (Cable Suspension Bridge 1.5 m wide)	0.010	0		
Protection/Drain Works	**Average Cost (Cr./m)**			
Gabion Wall (6 m ht.)	7.8506			
Utility Duct (600 mm ht. 500 mm width)	0.5189			
Dry Rubble (5 m Ht. with intermediate RCC belt)	8.7000			
Box Drain (600 mm ht. 600 mm width)				included in the cost of the road
***C/W refers to Carriageway**				

Table 9-5: *Unit Cost of Road & Bridge Works (Damage and New Construction)*

Table 9-6: *Loss Components of Road & Bridge Works*

Description	Total Cost (INR Cr.)
Bailey Bridge Installation	1
Debris Removal from Road	1
Total Cost	**2.00**

Table 9-7: *Damage And Loss Components of Road & Bridge Works*

Category	Total Damage Estimate (INR Cr.)	Total Losses Estimate (INR Cr.)	Damage +Loss Estimate (INR Cr.)
Components of Damage	28.41	0	28.41
Components of Losses	0	2	2
Total	**28.41**	**2**	**30.41**

Socio-Economic Impact on People

The Meppadi Grama Panchayat is located in a high disaster-prone area. Events triggered by climate change such as extremely high daily rainfall and land use changes are leading to an increased risk of landslides and flood disaster. The mainstay of the population in Meppadi Grama Panchayat is tea plantation, agriculture, horticulture and tourism, including home stays. The recent landslide on 30th July 2024 in Chooralmala has severely shaken the lives of the people in the area.

The affected families are suffering from emotional shock, psychosocial damage, hardship and trauma as well as great uncertainty having lost family members, valuable possessions, their homes including jewellery, official documents as well as relatives and friends. After the disaster, GoK temporarily relocated the affected families from the disaster area to relief camps and then to rented accommodations. The schools in the area were damaged and the school children are being admitted to other schools in Meppadi Grama Panchayat for the time being.

The government is actively considering declaring the disaster affected area as a red and yellow zone based on the initial recommendation of the expert committee, where no further construction for residential and commercial purposes and human settlement will be allowed.

Plantation and tourism activities shall continue with revised guidelines and standards to be issued.The affected families are to be accommodated in a model “low carbon and resilient community” to be built either in one or more locations depending on the availability of land in the region.

9.4. Response by the Government

GoK, using its own resources, has started providing immediate short-term repair of pavements and cross drainage structure, clearance of debris and temporary protection works to restore the access and keep the roads trafficable from Meppadi to Chooralmala.

The strengthening of Bailey bridge foundation work is currently being undertaken to keep the road access to Mundakkai and Punjarimattam.

9.5. Reconstruction and Recovery Needs Assessment

GoK has decided not to rehabilitate the people in the disaster affected areas. The recovery strategy however needs to ensure service level resilience of the existing road network applying BBB (Build Back Better) principles. Network level resilience is important keeping in view the needs of plantation workers, serviceability of the network during the event of disaster for evacuation and to promote responsible tourism activities to this unique topography and diverse ecosystem. As an eco-sensitive region, it faces threats from unregulated land use changes, uncontrolled tourism, climate change etc which underscores the immediate need for sustainable practices and ecosystem DRR approaches.

Short Term (0-9 months)

The roads to establish connectivity to the tea estate and the plantation shall be reconstructed/rehabilitated with no widening (8.6 km of village roads having carriageway widths of 3.5-3.8 m and 1 km of SH with carriageway widths of 7 m) except for one or two locations having sharp hairpin bends with low visibility of the approaching traffic for safe passage of two vehicles at one time.

The reconstruction and recovery of road works should lay focus on disaster and climate resilience with a package of engineering and non-engineering climate resilient measures, e.g., pavement crust repairs, slope protection works along the hillside at critical landslide hotspots with combination of breast and retaining walls with gabions or DR walls and bio-engineering works/bamboo crib walls/plantation, hillside lined drains (U type), reconstruction of box/slab culverts for accommodating new stream flows, protection works for CD structures; toe wall protections against river erosion preferably using gabions considering soft soil mass. This work is expected to be completed within the short-term period (0–9 months), with river training works to be primarily undertaken by the Irrigation Department and is not included in this estimate.



Figure 9-4: *Bamboo Crib walls*

Medium Term (9-24 months)

Under the state's hill highway program, the contract for road rehabilitation works with 3 years of maintenance was issued for 12.4 km of 2-lane SH Meppadi-Chooralmala to ULCCS Ltd. In February 2024 at a contract price of INR 30 Cr. This is the only connector road to Chooralmala which passes through Puttumala which had witnessed a deadly landslide in 2019 with considerable mudflow and widening of the valley. In order to incorporate service level resilience some additional resilience features also need to be incorporated to this connector road as part of resilient recovery. These features will include hillside drain cum duct for accommodating utilities, additional protection measures at existing culvert at Puttumala and some additional culverts and a pedestrian suspension bridge sufficiently above HFL at this location which can serve both as community escape route during disasters as well as tourist appeal, hill protection works at some locations.

In addition, considering the high risk of landslides in Meppadi, a helipad is proposed to be



Figure 9-5: *Pedestrian Bridge - Illustration (Proposed)*

Figure 9-6: *Helipad - Illustration (Proposed)*



constructed at strategic location and explore if flying services can be operated on a Public-Private Partnership (PPP) mode and that support tourism activities, transport of high value plantation/forest produce.

The PPP contract shall have inbuilt obligations for PPP contractors for maintaining the helipad infrastructure as well as providing emergency services in the event of a disaster for evacuation of people as well as supply of disaster relief materials.

Two bridges are required to be reconstructed over Iruvazhinji river i.e., one at Chooralmala and one at Mundakkai to establish the required road connectivity to the area. For bridges most critical aspect would be the choice of bridge location and its exposure to future hazards, type of structure, design parameters like HFL, resilience features adopted to deal with hazards including foundation type to avoid river scours as well as measures to protect impact of debris flow, need for debris arrestors, river protection works to channelise river flow, reduce scour effects and time needed for reconstruction.

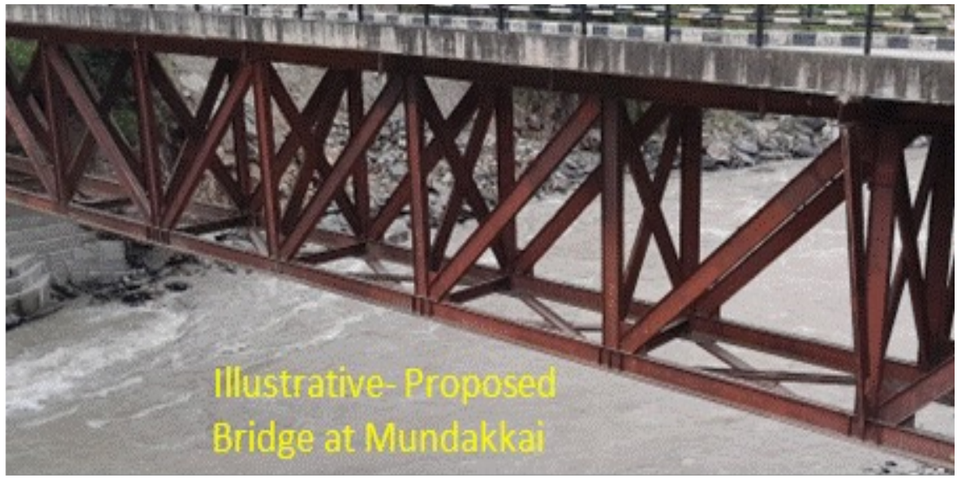
PWD would conduct detailed due diligence on all these aspects while designing the bridges and also establish a good coordination mechanism for river training works. Options for bow string semi-arch/PSC extradosed bridges were discussed for Chooralmala and steel truss with RCC deck for Mundakkai without any pier in between (which can be constructed quickly. A few more additional box culverts would be considered for accommodating new stream flows, particularly at approaches to the bridges.

Additionally, cross-sectoral interventions like river training works/channelization, dykes, and check dams, particularly for these new bridges, are also seen as a critical need to reduce scours of hill toes and abutment sides. Some of these aspects would be considered under river training works by the Irrigation Department. In this context, it is also important to mention that bridge construction contracts require at least 2



Table 9-7: *Bridge at Chooralmala (Proposed)*

Figure 9-8: *Bridge at Mundakkai (Proposed)*



years of Defect Liability Period (DLP) with health monitoring and reporting by the contractor and at least 5 years of O&M period. Bridge works are expected to be completed in the medium-long term period (9–36 months).

Long Term (24-36 Months)

The catastrophic landslide in Meppadi Grama Panchayat has underscored the urgent need for developing a sustainable and resilient hill township. Accordingly, GoK has in principle decided to notify the disaster impacted zone as a non-habitable and took decision to resettle the disaster impacted families to a newly constructed model resilient and low carbon township. The broad concept of this township is to accommodate a combination of terraced farming and homestead style settlement model keeping in mind the hilly terrain of Wayanad.

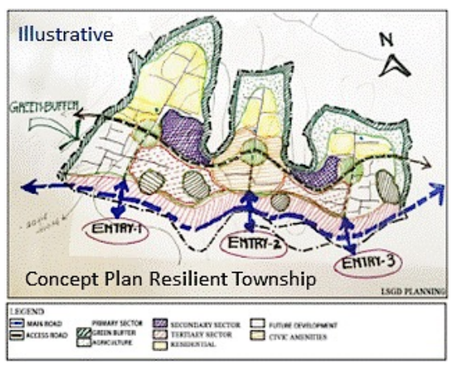


Figure 9-9: *Concept Plan - Resilient Township -Illustration*

Nedumbala Estate in Meppadi Panchayat and Elstone Estate in Kalpetta Municipality are the sites chosen by the Kerala government to build model townships for the rehabilitation of people affected by the Wayanad landslide, with a combined area of 356 acres (144 hectares). The township is to be developed with an initial housing capacity of 600 families with incremental capacity to accommodate 2000 families. In the long-term recovery, it is assumed that a 5 km of intermediate lane arterial road is needed to connect the proposed township and another 15 km of single-lane internal paved roads (bituminous, 3.8 m carriageway width) with footpaths on one side (1.5 m) and cycle tracks (2 m) with lined drains and utility ducts under the same connecting individual houses.

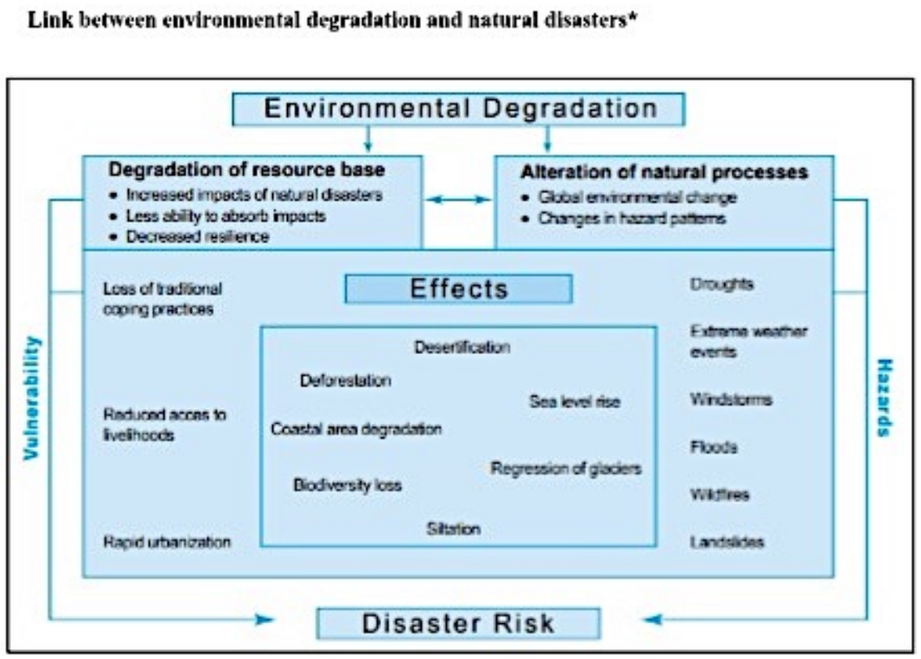
Some part of the road construction activities for the new township will be conducted in the medium-term (say 50%). The new township construction activities shall embrace low carbon and sustainable methods and reliance on nature-based solutions. The township shall also regulate use of ICE vehicles and provide good EV

Table 9-8 *Asset-Wise Reconstruction & Recovery Cost Estimates For Meppadi G.P. (Short, Medium And Long Term In INR Cr.)*

Asset Type	Short Term (0-9 Months)	Medium Term (9-24 Months)	Long Term (24-36 Months)	Total Cost (INR Cr.)
Reconstruction of damaged roads with river training works, breast/ retaining walls and drains	32.98	0	0	32.98
Resilient Road Culvert Reconstruction Program	0.51			0.51
Resilient Road Bridge Reconstruction Program including approaches*		31.64	31.64	63.28
Resilient Recovery Interventions on Meppadi- Chooralmala Road (SH-59 including pedestrian bridge for community/service resilience)		13.32		13.32
Approach road and Internal Road Network with footpath and cycle tracks for the New Township and other low carbon and resilient interventions		70.3	70.3	140.6
Construction of one Helipad at a strategic location in Meppadi Grama Panchayat with 2 km approach road		9.43		9.43
Total	**33.49**	**124.69**	**101.94**	**260.12**

* River training and bridge protection works to be considered by the Irrigation Department

Figure 9-10 *Link between Environmental degradation and natural disasters*



public bus transport services with identified bus stops and public EV charging stations.

The overall reconstruction and recovery needs (infrastructure costs) in the short, medium and long term has been estimated at INR 260.12 Cr and is presented in ***Table 9-8***.

9.6. Resilient Recovery Framework

Complex relationships between environmental variables and disasters can significantly affect development, especially in terms of "building back better." Natural disasters and environmental degradation are intricately related and have a significant influence on development, particularly on man-made infrastructure.

Further, the frequency and intensity of natural disasters can be increased by environmental degradation, including climate change. This can exacerbate vulnerabilities and undermine development gains, particularly in the area of poverty alleviation, as the poor are disproportionately affected by disasters and have limited coping mechanisms.

The importance of environmental protection is clearly stated in one of the principles of the "Yokohama Strategy and Plan of Action for a Safer World" in 1994. It emphasizes that environmental protection is a crucial aspect of sustainable development, which is in line with efforts to reduce poverty and is necessary for preventing and reducing the impact of disaster.

Similarly, the Hyogo Framework of Action explicitly delineated the connections between wider disaster risk management and vulnerabilities arising from environmental deterioration. Furthermore, it acknowledges the potential of ecosystem services, environmental management, and environmental information to mitigate disaster risk, alleviate poverty, and promote sustainable development. Therefore, these policy guidelines direct integration of environmental management into all operations that contribute to Disaster Risk Management and vice versa.

Investing in environmental management or good ecosystem management can provide cost-effective options for lowering vulnerability to catastrophes and improving resilience to climate change. If preventive disaster management and post-disaster recovery work are not considered using ecologically sustainable methods and practices, it can result in maladaptation and increased environmental deterioration. As per the World Bank (2018), for each US $1 invested in conservation, about US $16 is saved down the road from destruction.

Ecosystem-Based Disaster Risk Reduction (ECODRR)

Eco-DRR refers to conserving and managing ecosystems to establish proper functioning, which in turn helps to reduce disaster risk and enhance community sustainability. Protecting ecosystems to ensure their full functioning helps reduce disaster damage. Thus, understanding the concept of Eco-DRR starts with an appreciation of the services provided by the ecosystem and how they are linked to disaster risk reduction.

Eco-DRR entails combining natural resources management approaches, or nature-based solutions or the sustainable management of ecosystems, with DRR methods. And in order to apply the above mentioned approaches, three important steps of assessments are required –

a) assessing the ecosystem services being provided by the environment which is important to maintain which in turn will reduce the risk of disaster

b) assessing the risk of environmental degradation that will happen temporary and or permanent for the proposed work

c) assessing what mitigation measures including nature-based/ ecological/ Eco-DRR measures that can be adopted to avoid, reduce and mitigate any kind of environmental destruction.

Thus, it is envisaged that Wayanad recovery and reconstruction efforts would entail considerations for Eco-DRR. In this regard, PWD will take the opportunity to be guided by relevant technical studies and address the district level climate risk and vulnerabilities for better informed planning of the road and bridge assets. Some of the recommended studies include:

- Detailed Project Report for Bridges at the Disaster Site: Site Selection, investigation, detailed design and proof checking for 2 road bridges (Chooralmala and Mundakkai) along with river protection works and 1 pedestrian suspension bridge at Puthumala.

- Study on landslide hazard investigation and mitigation plan for identified critical SH and MDRs network in Wayanad district based on historical information of such disasters and the impact of tunnelling works in this region on stability of mountain slopes. A framework ecosystem approach to road and bridge construction should be laid as part of this study. At least 2 training of one day each shall be conducted for engineers in PWD/LSGD- in Wayanad (for at-least 50 nos. of engineers).

- Weak bridge inventory, condition survey and climate resilience audit for SH & MDR network in Wayanad district that are subjected to high climate and disaster risks (floods and landslides) and determine its resilient reconstruction and rehabilitation strategy along with associated resilience measures like river training works. The technical advice should develop a common guidance for resilience audits and disaster risk reduction and resilient approaches reconstruction/rehabilitation of weak bridges. It would attempt to prepare designs and bridge health monitoring for weak bridges facing increased climate and disaster risks in Wayanad. The learnings from the study can be adopted as part of PWD manual for mainstreaming in the state. The study should cover at least 2 trainings of one day each shall be conducted for PWD/LSGD-Wayanad engineers (at least 50 Nos. of engineers).

Impact of Recovery

The proposed recovery and reconstruction interventions when undertaken will directly contribute to the resilient recovery of the disaster impacted location and also enable the process of mainstreaming the resilient approaches for future planning, design and execution of works in Wayanad.

The state needs a "whole of system" approach for resilient transport networks with due understanding of flood and landslide hazards while planning the infrastructure and associated river training works to enable Disaster Risk Reduction of the road and bridge sector.

Table 9-9: *Recovery and Reconstruction Framework for Roads & Bridges*

Recovery and Reconstruction Needs	Amount (INR Cr.)	Responsible Department	Supporting Department	Funding Source	Time-line
Reconstruction of damaged roads with river training works, breast/ retaining walls and drains	32.98	PWD	LSGD, WRD/ Irrigation Dept, Forest	GoK/ NDRF/RKI	0-9 Months
Resilient Road Culvert Reconstruction Program	0.51	PWD	LSGD, WRD/ Irrigation Dept	GoK/ NDRF/RKI	0-9 Months
Resilient Road Bridge Reconstruction Program	63.28	PWD	LSGD, WRD/ Irrigation Department	GoK/ NDRF/RKI	0-36 Months
Resilient Recovery Interventions on Meppadi- Chooralmala Road (SH-59 including pedestrian bridge for community/service resilience)	13.32	PWD	LSGD, Forest	GoK/ NDRF/RKI	0-24 Months
Approach road and Internal Road Network with footpath and cycle tracks for the New Township and other low carbon and resilient interventions	140.6	PWD	LSGD, WRD-Irrigation and Forest	GoK/ NDRF/ RKI	0-36 Months
Construction of one Helipad at a strategic location in Meppadi G.P. for disaster evacuation and other demands	9.43	PWD	LSGD, WRD-Irrigation and Forest	GoK/ NDRF/RKI	0-24 Months
Climate informed resilient planning and capacity building (Refer section 3.2.7)					
Detailed Investigations and Engineering for New Bridges and supporting river training works	1.5	PWD	LSGD/KSDMA/ WRD-Irrigation	GoK/RKI	0-3 Months
Landslide hazard investigation for SH & MDRs in Wayanad with 2 trainings	3.0	PWD	LSGD/ KSDMA/ WRD-Irrigation	GoK/RKI	0-12 Months

Recovery and Reconstruction Needs	Amount (INR Cr.)	Responsible Department	Supporting Department	Funding Source	Time-line
Weak and Old bridge inventory, condition survey and resilience audit with framework for resilient reconstruction and rehabilitation/health monitoring program for Wayanad	3.0	PWD	LSGD/KSDMA/ WRD-Irrigation	GoK/RKI	0-12 Months
Policy Linkages	***Refer section 3.2.7** above for Ecosystem-Based Disaster Risk Reduction principles and its implications for road sector*				
Disaster Risk Reduction Measures					
Total (In INR Cr.)	**267.62**				



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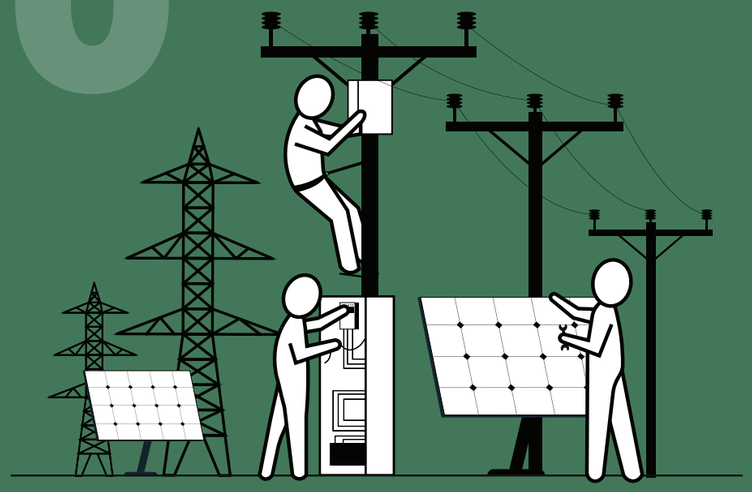


Power

10.1. Basic Profile of the Sector

Electricity generation and distribution in Kerala began with private companies and municipalities in the 20th century. In 1910, the Travancore State Electricity Board was established to oversee the power generation and distribution in the princely state of Travancore. In 1940, the Cochin State Electricity Board was formed to manage the power supply in the state. The Government of Kerala was formed in 1956 by merging the states of Travancore, Cochin, and Malabar. In 1957, the Kerala State Electricity Board was established by merging the electricity departments of these princely states.

The objective of the Post Disaster Needs Assessment (PDNA) in the Power Supply Sector is to identify the damage and losses caused to the power sector by the landslide and thereby assess the larger impact on the economy of the state or region. A better understanding of the recovery needs of the power sector ensures a resilient rebuilding process. In certain areas, the electricity distribution network has been severely damaged.

Landslides and floods are commonly associated with power outages. Erosion due to the floodwaters and landslides triggered by floods undermines the foundations of transmission towers and electrical infrastructure. Serious, and often explosive, damage may occur when electrified equipment comes in contact with water, while moisture and dirt intrusion require time consuming repairs of inundated equipment. In contrast to earthquakes, early warning is possible and enables electric utilities to shut off power to facilities in flood zones, therefore minimizing damage. The most effective mitigation strategies included elevation, levees, and locating critical facilities outside the flood zone. Recovery time was driven by the number of needed repairs and site access, as repairs

cannot start until floodwaters have receded.

Other factors affecting the power grid recovery time in the aftermath of natural disasters include the resilience of electric power utilities and the disruption of other critical infrastructure (mainly transportation and telecommunications), either as a direct result of the natural event or because of the loss of power supply.

The damage and loss data on the power sector was provided by KSEB Ltd. (Power Utility Company). In most of the places, the entire electrical network, such as transformers, poles, over-head lines, and all the accessories, washed away in the floods and could not be recovered. As the entire village of Chooralmala has washed away, it has resulted in power cuts and blackouts in different areas. The state electricity board worked meticulously to restore the power supply with minimum manpower and restored power within 72 hours (by 4th August 2024).

10.2. Sectoral Policies

Hydro Power Policy (2006)

The Hydropower policy (2006) was designed with the vision of catalysing the development of Kerala. It aimed to ensure that affordable, reliable, and high-quality power is available to consumers around the clock, throughout the year. Simultaneously, the policy aimed to generate employment opportunities in power projects while addressing social, economic, and environmental impacts. The policy also addresses the multiple provisions of the Electricity Act (2003), emphasising the enhancement of efficiency, safeguarding consumer interests, tariff regulation, fortifying regulatory bodies, and ensuring equitable open access for various user categories.

The status of power generation in the state is:

1. Total hydropower as of March 31, 2023 is 2090.38 MW.
2. WindPower:2.03MW,
3. Solar: 47.54MW
4. The closest hydroelectric station is Kuttiady Augmentation Project, which is 225 MW.
5. There are also small hybrid projects in nearby districts having a total capacity of 12.1 MW.

Electricity policies in India for utilities

1. The Central Electricity Authority (CEA) is a competent technical authority of the Govt. of India; it formulates regulations from time to time in accordance with the Electricity Act, 2010 and carries out the provisions of the Act.
2. Central Electricity Authority (Grid Standards for Operation & Maintenance of Transmission Lines) Regulations, 2010
3. Central Electricity Authority (measures relating to safety and electric supply) Regulations, 2010
4. Central Electricity Authority (Technical Standards for Construction of Electric Plants and Electric Lines) Regulations, 2010
5. Central Electricity Authority (Safety Requirements for Construction, Operation, and Maintenance of Electrical Plants and Electrical Lines) Regulations, 2011
6. Central Electricity Authority (Technical Standards for Connectivity to the Grid) (Amendment) Regulations, 2010
7. CEA Report on Cyclone Resilient Robust Transmission and Distribution Infrastructure, March 2021
8. Disaster management plan for the power sector by GOI, January 2021, prepared by CEA.

Codes and Indian Standards

Generally, electricity utilities adopt the following IS Codes for the construction of electrical lines and substations:

1. IS 5613 (Part 1/Sec 1): Code of Practice for Design, Installation, and Maintenance of Overhead Power Lines Up to and including 11 kV – Section 1 Design
2. IS 5613 (Part 1/Sec 2): Code of Practice for Design, Installation, and Maintenance of Overhead Power Lines Up to and including 11 kV—Section 2: Installation and Maintenance

Sl. No.	Type of Building		Fully damaged	Partially Damaged	Not damaged but unfit	Safe	Washed away	Not located
1	House	Ward-10	61	35	54	160	54	34
		Ward-11	32	53	74	51	55	
		Ward-12	52	82	112	216	74	
2	Commercial	Ward-10	12	4	0	14	0	
		Ward-11	3	0	4	13	2	
		Ward-12	0	3	10	47	1	
3	Industrial	Ward-10	2	0	0	0	0	
		Ward-11	0	0	1	2	0	
		Ward-12	0	0	0	1	0	
4	Others	Ward-10	38	5	24	39	7	
		Ward-11	1	2	9	7	1	
		Ward-12	2	3	15	11	4	
5	Office	Ward-10	2	0	0	3	0	
		Ward-11	0	0	0	2	0	
		Ward-12	1	2	3	1	0	
6	Shop	Ward-10	15	5	2	7	0	
		Ward-11	4	0	0	0	9	
		Ward-12	5	0	10	2	0	
7	Not specified	Ward-10	4	2	16	18	12	
		Ward-11	3	4	7	11	5	
		Ward-12	4	0	4	21	12	
8	Cattle shed	Ward-10	0	0	0	0	0	
		Ward-11	0	0	1	1	0	
		Ward-12	0	0	0	1	0	
	Total		**241**	**200**	**346**	**628**	**236**	**34**
	GRAND TOTAL		**1685**					
[Source: Meppadi Grama Panchayat through KSEB Ltd.]								

Table 10-1: *Rapid Visual Screening of Meppadi Grama Panchayat Landslide Consolidated Data (As per Go (Rt) No. 579/2024/DMD Dated 06.08.2024*

3. IS 802: Use of Structural Steel in Overhead Transmission Line Towers—Code of Practice—Design Strength

4. IS 4091: Design and construction of foundation for transmission line tower and pole

10.3. Damage Assessment Process

A team comprising the power sector experts, the state-level engineers, and the district-level officers joined together for a capacity-building exercise for one day on 26th August 2024. The basic concept and process of conducting PDNA were introduced. In the afternoon, the participants and the experts went for a field visit to carry out a hands-on exercise on damage assessment.

This report outlines the damages and losses faced by KSEB Ltd. (Kerala State Electricity Board Ltd.) during the flood that occurred during the landslide and floods. The damage and loss assumptions are taken from the Schedule of Rates book issued on 12th February 2024 provided to KSEB Ltd.

The costs of damages, losses, and recovery in the affected area are summarized in the following ***Table 10-1***.

10.4. Damage And Loss Estimate

The total amount for damages is calculated to INR 9,16,79,000 which includes damages to the structures, transformers, conductors and civil structures of KSEB Ltd in ***Table 10-2***. This will persist since the land designated for the installation of transformers, poles, and plinths is unsuitable for flood resilience.

The distribution transformers and structures are being washed out because of the poor placement. Changes in the designs of the foundations and structures are highly recommended to with-stand the flood impacts. It took the workers more than 10 days to reconstruct the structures and give back the connections temporarily. Major distribution transformers are washed out, which shall be replaced completely to fulfill the total demand of the consumer.

The total amount for losses is calculated as INR 9.1679 Cr, which includes temporary connections, vehicle movement for cleaning up the debris, manpower for reconstruction, forgone income and other unexpected expenses.

Sl. No	Damaged Assets	Quantity	Rate in Lakhs	Amount in INR Cr.
1	100KVA Transformers	5	5	0.25
2	11KV HT Line in KMS	24.5	11.5	2.81
3	3 Phase, 415 V line in KMS	42	7	2.94
4	Single Phase 230 V line in KMS	70	3.8	2.66
5	11KV Double Pole Structures	18	0.28	0.05
6	Consumer meter, service facility etc.	Lumpsum		0.45
	Total			**INR 9.16 Cr**

Table 10-2: *The Total Damage and Losses of the Power Sector*

Cascading Impact of Disruption of Power Sector

Impact on Power Sector

Hydro Generation, Transmission and Distribution sectors are most affected in the present calamities. There will be a sudden rise in the demand for a considerable quantity of construction materials and human resources to reconstruct, repair and retrofit the power infrastructures like Distribution Substations, lines etc.

Impact on Essential Services

Because of power failure, most of the establishments are closed. Essential services like hospitals, water supply, shelter homes, food processing industries, MSME, tourism, administrative offices, etc. are facing a lot of difficulties. Tourism, which is a major source of income in the region, is adversely affected and may take months to revive.

Impact on Industrial Sector

All industries have stopped their production due to power failure during the disaster and they incurred huge losses. Food processing industries are mostly affected due to preservation of raw materials and wasted due to long power supply failure. Those industries can only be operational after repairing lines and substations.

Sl. No	Item	Quantity	Rate	Amount in Cr.
1	Installation of 160 KVA 11 KV Transformers	3	INR 6,50,000.00	INR 19,50,000.00
2	Construction of 11 KV HT UG cable from Koothumunda to Chooralmala 35 KM	35	INR 36,00,000.00	INR 12,60,00,000.00
3	Construction of 415 Volts ABC cable with H Poles in KM	30	INR13,80,000.00	INR 4,14,00,000
4	Installing 11 KV cubicles at 66 KV Koothumunda	2	INR 5,00,000.00	INR 10,00,000.00
5	Installing 11 KV cubicles with mobile Controller	5	INR 550000	INR 27,50,000
	Total			**INR 17,31,00,000.00**
Costs are based on KSEB LTD Schedule of rates				
Additional cost for providing for improvements suggested below: • Transformer Pedestal: INR 50,000/- per pedestal • H type poles for LT 3 Phase poles: INR 20000/- pole. • Providing cable trench for 11 KV cable from Koothumundai to Chooralmala : INR 40000/- per KM.				

Table 10-3: *Cost Estimation of Proposed Restoration Work*

Capacity Building requirements

As per DMP 2018, DOE has developed a framework to build capacity by categorizing training programs with the targeted audience and it needs to be implemented.

Capacity Building: Engineers and Officers

According to Central Electricity Authority Regulation 2010, there is a requirement for training and development of skills on disaster response and management as a part of the program, for the personnel involved in the operation and maintenance of generation.

Approach for Training

- To ensure learning in a variety of situations spanning hazards, and levels, diverse training methods and methodologies must be used. Training methods comprises theoretical training which is a cognitive method and practical training aimed at developing

SI. No	Training Programs	Key Component	Target Audience
1	Awareness and sensitization on Best Disaster Management with the existing resource	Planning for deployment of the technical and non- technical groups during the emergency Checking the available tools and allotment to each group	Superintending Engineer, Executive Engineer, SDO and Junior Manager of the concerned area
2	Training and development Skill	CEA guidelines relating to safety and electric supply Use of safety tools during a disaster	Executive Engineer, SDO and Junior Manager of the concerned area
3	Preplanning of material Procurement and Services	Earmarking of Budget Delegation of financial power for Disaster Management	Superintending Engineer, Executive Engineer of the concerned area
4	Approach for restoration of power supply on priority	Restoration of power supply on priority according to the nature of Public Service of the Institution	Executive Engineer, SDO and Junior Manager of the concerned area
5	Training Program on Safety	Mock Drill	All Electricity Staff officers and Contractor.

Table 10-4: *Capacity Building Requirements*

Table 10-5: Capacity Development for Key Aspects of DRR

Key Aspects	Brief Description	Training Approach	Intended Audience
Prevention or mitigation for disaster risk reduction	• Knowledge session on climate change and its impact on power utility. • Risk assessment and Vulnerability study in each area of responsibility. • Mainstreaming of disaster risk assessment, mapping and management into development plans and programs. • Building Resilience in Electricity Infrastructure.	• Interactive lecture sessions • Discussions • Online training • Observation and study tour • Workshops, seminars, and conferences	• Government Officials
	• Public Awareness Programs. • Promote culture of disaster risk prevention, mitigation, and better risk management. • Awareness about precautions to be taken and emergency communication details of nodal officers	• Awareness Campaign • Pamphlet and Booklet • Permanent Notice board at all suitable place	• Executives & non-executives • NGOs
Effective preparedness and response	• Response and recovery • Responsibilities of Teams • Black Start Facilities • Emergency Restoration Systems (ERS) • Rescue equipment at all levels • Adoption and adaptation of emerging global good practices • Early warnings, maps/ satellite data/ effective dissemination of information • Systems to provide basic services in emergencies • Media relations	• Mock Drill Exercises • Promote planning and execution of emergency drills and restoration • Demonstrations • Field Assignments • Peer to peer twining • Case Studies • Media communications	• Executives Non– Executives NGOs • Government officials and Executives

Key Aspects	Brief Description	Training Approach	Intended Audience
Recovery and Build Back Better	• Post-event investigation & analysis and strategy for the future. • Damage assessment mechanisms. • Planning capabilities to ensure coherence of BBB with overall development efforts and goals. • Studies on past disasters and recovery to draw useful lessons	• Training Sessions • Field Assignments • Workshop • Observation and study tour • Brainstorming Exercise	• Government officials and Executives

behavioural skills, detailed in ***Table 10-5***.

- Training based on disaster management could be facilitated through workshops, seminars and online training. The addition of interactive activities with this traditional segment is a necessary step in integrating disaster risk assessment and vulnerability study in power sector development plans and programs.

- Peer-to-peer twining on an adaptation of emerging global best practices in building resilience in the electricity sector aids learning about new applications, new processes, or new technologies.

- Observations and study tours demonstrate a fruitful approach to studying past disasters and conducting a post-disaster damage assessment. The inclusion of physical training such as mock drills, field assignments, case studies, and simulation exercises along with the above exercises is an effective approach for the recovery and restoration phase.

10.5. Impact of Recovery

The Government of Kerala, using its own resources, has started providing immediate short-term repair of energy access, clearance of debris, temporary connection etc. Most of the restoration works were done with the immediate intent of restoring the supply to the consumers by extending supply with the help of weather-proof wire, rectification of fallen poles, re-conducting/re-stringing of snapped conductor, replacement of faulty distribution transformer, rectification of fallen LT / HT lines and clearing of fallen trees / branches/boulders etc.

Sector Recovery Strategy

Role of Line Departments

All the government construction departments need to coordinate with each other for the procurement of materials for the reconstruction work. However, they need to strengthen their capacity in DRR by undergoing training. For monitoring and control, an adequate number of staff should be deputed with a clear job description.

Need Analysis

The framework would set the groundwork as a way forward to improve the resilience of state infrastructure and its communities from future natural disaster. Based on the needs assessment, the overall distribution sector would need to be significantly reconstructed.

Additionally, to enhance disaster resilience, technological interventions are suggested.

Medium to short term recovery strategy should focus on embracing the latest technology principles and work towards improving the planning, design, construction and operation and maintenance practices, particularly in the areas with distribution and flooding risks.

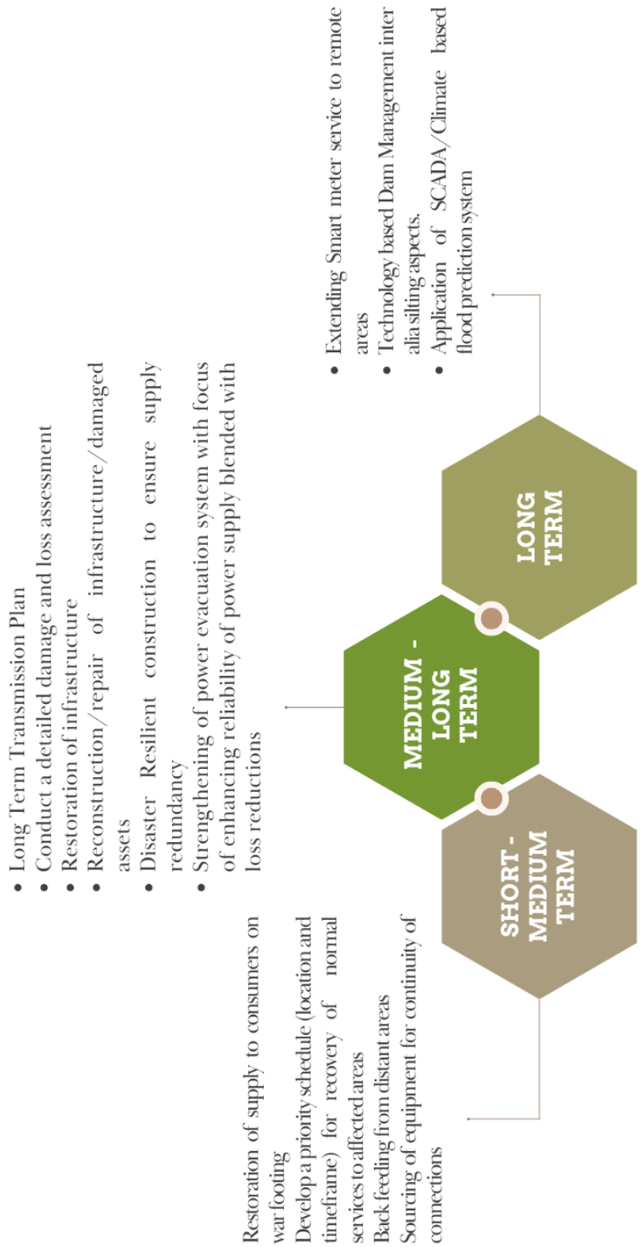


Figure 10-1: *Recovery Road Map for Power Sector*

The state must start evolving towards newer transmission technology area and look at adopting them on an urgent basis.

Build Back Better Requirements

KSEB Ltd has decided that the re-building activity will follow the principle of building back better. It is recommended to implement latest technological and more resilient solutions.

- The distribution poles to be used should be higher than the maximum flood limits on a solid foundation that too firmly grouted. Providing H poles and reducing distance between poles.
- Application of SCADA based Flood prediction system.
- Climate proofing of Distribution transformers.
- Use of multi circuit towers
- Retaining is essential if the transformers are to be positioned on a slope.
- The distribution of power should be underground; however its initial cost is high, but it needs less maintenance.

10.6. Recommendations

Power Infrastructures to be rebuilt with reference to latest standards. Erosion and landslides triggered by floods undermine the foundations of transmission tower. Significant or even catastrophic damage may occur when electrified equipment comes in contact with water, while moisture and dirt intrusion require time-consuming repairs of inundated equipment.

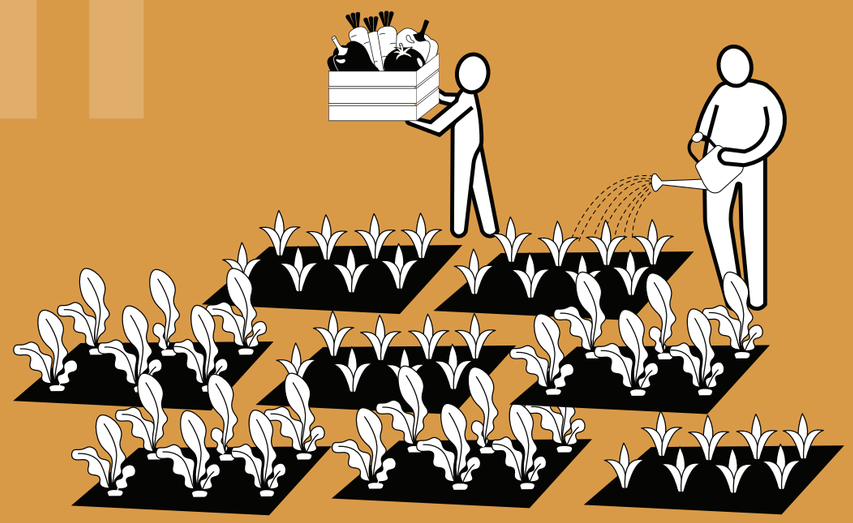
The most effective mitigation strategies included elevation, levees and locating critical facilities outside the flood zone. Recovery time was driven by the same parameters as in the case of landslides, namely the sheer number of needed repairs, and access as repairs cannot start until floodwaters have receded.

- Substation foundations to be constructed considering local DFL and pole foundations. Electrical Infrastructures need to be relocated to a safe zone other than landslide zone.
- In contrast to earthquakes, early warning is possible, and enables electric utilities to shut off power to facilities in flood zones, therefore minimizing damage.
- Electric utility companies maintain a stock of spare items to handle daily repairs and minor emergencies. Extending these stocks to cover natural disasters and other major emergencies is a form of self-insurance and can expedite repairs and ultimately reduce the duration of outages.
- Interventions to make assets more resilient include using alternative materials, digging deeper foundations, elevating assets, building flood protection around the asset, or adding redundant components. Making infrastructure more resilient by strengthening assets would be more realistic and bear the desired results, with appropriate data on the spatial distribution of natural hazards are available.



PRODUCTIVE SECTOR

11



Agriculture and Horticulture

11.1. Basic Profile of the Sector

Given Kerala's diverse climatic conditions, landforms, and soils, the state has been divided into twenty-three agroecological units (AEUs). Wayanad district falls within three units: AEU-15 Northern High Hills, AEU-20 Wayanad Central Plateau, and AEU-21 Wayanad Eastern Plateau. Wayanad, etymologically originated from the Malayalam word "Vayalnad" (meaning "paddy field place"), is indicative of the district's agricultural heritage. As Kerala's sole aspirational district, its unique landscape, characterised by mountainous terrain, lush forests, and a relatively cool climate, offers ideal conditions for cultivating diverse crops. Rice, the primary food crop, is widely cultivated, particularly in the lower valleys, and traditional fragrant rice cultivars like Gandhakasala and Jeerakasala highlight the region's agricultural legacy.

Beyond rice, Wayanad's agricultural prowess extends to spice and cash crop production. Black pepper, cardamom, and ginger are the major cash crops that thrive in the district's favourable climate and soil. Coffee, including Arabica and Robusta varieties, flourishes in the region's steep topography. Tea is another cash crop cultivated in several locations, including the landslide-affected Meppadi.

A vibrant horticultural sector enriches Wayanad's agricultural landscape. A diverse array of fruits, including bananas, jackfruit, papaya, mangoes, and guava, are cultivated in the district. Alongside temperate crops like carrots and cabbage grown at higher altitudes, Wayanad produces beans, tomatoes, cucumbers, and leafy greens. Tuber crops, such as yams and tapioca, are widely farmed and serve as indispensable staples and income sources. The region's unique climate further enhances its agricultural diversity, enabling the cultivation of various exotic fruits and flowers.

Wayanad's Transition to Organic Farming

In recent years, Wayanad has witnessed a growing interest in organic farming, with many farmers adopting sustainable practices to preserve soil health and biodiversity. However, the region faces challenges such as unpredictable weather patterns, soil erosion, deteriorating soil fertility, and the impacts of landslides and heavy rains. Despite these difficulties, agriculture and horticulture remain the backbone of Wayanad's economy, providing employment to a significant portion of the population and contributing substantially to local consumption and exports.

Cultivation Patterns in Meppadi Grama Panchayat

In Meppadi grama panchayat, the agricultural landscape is characterised by the cultivation of major crops such as coffee, cardamom, black pepper, and tea on farmlands. Homesteads commonly cultivate coconut, areca nut, banana, vegetables, and fruit plants.

11.2. Sectoral Policies

Wayanad's agricultural and horticultural sectors are significantly influenced by a combination of state-level and district-specific policies to promote sustainable practices, enhance productivity, and address the region's unique challenges. The following table outlines the significant policies and initiatives implemented at the state and district levels to support the agriculture and horticulture sectors in Wayanad:

Table 11-1: *GoK Initiatives to Promote Wayanad's Agri-Horticultural Sector*

Sl. No:	Areas	Policies/Initiatives
1	Organic Farming Promotion	• Transition to Organic Farming: Encourages a shift from conventional to organic farming practices across the state. • Sustainable Practices: Promotes the adoption of sustainable agricultural methods. • Support for Organic Farming: Support for organic certification, marketing initiatives, and farmer training. • Financial Incentives: Offers subsidies for organic inputs such as bio-fertilizers and biopesticides.
2	Integrated Farming Systems (IFS	• To enhance resilience among small and marginal farmers. • Approach: Integrates agriculture, horticulture, animal husbandry, and agroforestry. • Benefits: Optimizes resource utilisation and ensures stable incomes throughout the year.
3	Spice and Coffee Cultivation Support	• Spice Cultivation Programs: Various initiatives by the Kerala government and the Spices Board of India support spice cultivation in Wayanad, focusing on improving quality and management practices. • Coffee Board Support: The Coffee Board of India assists Wayanad's coffee sector, focusing on enhancing productivity, quality, and market access.
4	Horticulture Development Programs	• Horticulture Development: Wayanad receives support from the Kerala Horticulture Mission to expand cultivation areas for horticultural crops, improve post-harvest management practices, and promote value addition. • Financial Incentives: The government offers subsidies for orchard establishment, greenhouse construction, and the adoption of modern horticultural techniques.
5	Climate-Resilient Agriculture	• Climate-Resilient Practices: Specific programs promote climate-resilient practices to mitigate the effects of climate change, such as unpredictable rainfall and landslides. • Critical Areas of Focus: These programs emphasise water conservation, soil health management, and adopting drought-resistant crop varieties.
6	Land Reforms & Farmer Welfare	• Paddy Land & Wetland Conservation: The Paddy Land and Wetland Conservation Act is crucial in preserving Wayanad's essential paddy fields and wetlands, contributing to ecological balance and agricultural sustainability. • Farmer Welfare Schemes: Various welfare schemes offer farmers crop insurance, financial assistance in case of natural calamities, and support for cooperative farming initiatives.
7	Market Linkages & Export Promotion	• Marketing and Export Facilitation: The Kerala Agro Industries Corporation is crucial in promoting the marketing and export of Wayanad's agricultural and horticultural produce, particularly spices and coffee. • Market Access and Fair Pricing: This support aims to expand market access for Wayanad's farmers and ensure they receive fair product prices.

Challenges and Future Directions

Understanding the Challenges

The recent landslide in Wayanad, likely due to changing climatic conditions and other factors, highlights the district's vulnerability. Despite these challenges, agriculture has been practised in the region with limitations. One significant issue is the conflict between humans and wildlife, which threatens crops and human lives. Additionally, soil erosion, decreased soil fertility, and market instability persist.

The Need for Sustainable Land Use and Disaster Management

The landslides underscore the importance of effective disaster management and sustainable land use planning. Future policies should prioritise sustainable agriculture, climate resilience, regenerative agriculture, and improved farmer livelihoods through diversified income streams and enhanced market access.

Government support and community based initiatives will address these issues and ensure Wayanad's long-term agricultural viability and food security.

Homestead Agriculture as a Resilient Strategy

Homestead agriculture, a traditional land use system characterised by agroforestry, high biodiversity, and multifaceted benefits, can offer climate resilience and mitigate the effects of unpredictable catastrophic events.

This system should be continued and expanded to include more components that provide additional income and sustainability. Integrated Farming Systems (IFS), incorporating diversified crop and animal components, can further enhance food and nutritional security in the affected area while providing livelihoods.

Restoring Agriculture in Affected Areas

Soil fertility must be prioritised to restore agriculture in the affected areas. Soil testing for physical, chemical, and biological attributes is essential. Desilting is necessary due to topsoil erosion and deposition before recommending site-specific crops.

Soil Conservation and Erosion Control

Stream banks can be protected using bamboo, reeds, and cane, planted in rows (2-3) with a spacing of 10-15 feet. The saplings cost approximately INR 50 per plant. The produce from these plants can be used as raw materials for small-scale industries. Vetiver grass (Chrysopogon zizanioides) is another viable option for soil conservation, known for its versatility in slope stabilisation, water quality improvement, pollution control, bioremediation, and other environmental applications.

Fodder Cultivation

Cultivating fodder crops in affected fallow lands can address the needs of Wayanad's cattle-rearing population, providing green fodder for livestock and mitigating soil erosion.

Leveraging Technology for Sustainable Agriculture

In the era of smart agriculture, introducing AI-powered mechanisms and sensors, such as Passive Infrared and infrared sensors, can offer innovative solutions for addressing human-wildlife conflicts and ensuring safety.

11.3. Damages in the Sector

The 2024 landslides in Meppadi, Wayanad, have profoundly impacted the region's agriculture, exacerbating local farmers' already challenging conditions. This has led to both short- and long-term consequences for the economy. These landslides were triggered by heavy, concentrated rainfall, intensified by climate change induced shifts in rain-bearing belts, leading to more frequent and severe rain events in the region. This phenomenon is linked to warming in the Arabian Sea, which promotes the formation of deep cloud systems that dump copious amounts of rain over the Western Ghats.

Agriculture in Wayanad, heavily reliant on soil stability and consistent weather patterns, has suffered significantly. The landslides ruined vast tracts of agricultural land, eroding soils and washing away crops. This has resulted in immediate crop losses and compromised the soil's long-term fertility, hindering farmers' ability to recover and replant in the future. Moreover,

Table 11-2: *Agricultural Land Area Damaged in Ha*

Cropping Pattern	Type	Fully Damaged	Severely Damaged	Partially damaged (50% of the reported area)
Annual Crops	Ginger	10		
	Banana	20		
	Tuber	50		
	Vegetables	5		
	Sub Total	**85**		
Perennial Crops	Coffee	100		
	Cardamom	100		
	Pepper	75		
	Coconut	5		
	Areacanut	10		
	Fruit plants (papaya)	30		
	Tea	200		
	Jack	10		
	Nutmeg	2		
	Cocoa	4		
	Mango	5		
	Sub Total	**541**		
Grand Total		**626**		

Item	Weed Cutter	Sprayer	Chain-saw	Other Imple-ments	Pump set and Accessories	Total (Nos
Number	80	150	18	750	200	1198

Table 11-3: *Damages to Farm Equipment and Machineries*

the landslides caused substantial disruptions to infrastructure, impeding agricultural activity. Roads and bridges used for transporting commodities to markets were damaged or destroyed, isolating villages and hindering the timely delivery of agricultural output. The economic impact is significant, as many farmers in the region rely on agriculture as their primary source of income.

In Meppadi Grama Panchayat, three wards—Ward 10 (Attamala), Ward 11 (Mundakkai), and Ward 12 (Chooralmala)—were severely affected by the landslides, which destroyed all standing structures, including annual and perennial crops, in their path and surrounding areas. Additionally, the landslides damaged farm implements, pump sets, and machinery. A total of 626 hectares of agricultural land was affected, of which 359 hectares belonged to small and marginal farmers (SMF) and 267 hectares belonged to non-SMF. The annual cropped area suffered damage to 85 hectares, while perennial crops were affected on 541 hectares [***Table 11-2 & Table 11-4***]. Damage to farm implements, pump sets, and machinery amounted to 1198 units, including weed cutters, chain saws, various sprayers, pump sets, accessories, and other farm equipment [***Table 11-3***].

The landslides caused significant silt deposition, massive boulder deposits, and severe soil erosion. Field visits revealed that the sedimentation of silt and debris reached several feet high. These events underscore the urgent need for improved land-use practices and stricter regulations on construction and development in ecologically sensitive areas. Historical deforestation and recent construction activities related to tourism and infrastructure development have weakened the region's ecological balance, making it more susceptible to such disasters.



Figure 11-1: *Meppadi landslide site*





Figure 11-2: *Loss of agriculture - Meppadi landslide site*

Figure 11-3: *Loss of agriculture (cash crop) - Meppadi landslide site*



Analysis of Agricultural Damage

Based on the data in ***Table 11-4***, the total damage to perennial crops was estimated to be INR 21.88 crores, calculated using unit costs provided by NABARD (2024-25). In contrast, annual crops (such as bananas, ginger, tubers, and vegetables) experienced damage amounting to INR 2.38 crores.

Stabilising damaged areas is likely to be challenging due to rocks and debris. However, with consistent efforts to rejuvenate the soil, reclamation can be achieved in the future. According to NABARD (2024-25), the unit cost for soil reclamation in the affected region is INR 1,81,300 per hectare. Furthermore, the damage to farm equipment, pump sets, and machinery was assessed to be INR 0.7275 Crs.

Particulars	Damaged (In Crores)	Severely Damaged (In Crores)	Partially Damaged (In Crores)	Total Damage Estimate (In Crores)
Perennial Crops (Replanting Cost)	21.88	NA	NA	21.88
Annual Crops (Replanting Cost)	2.38	NA	NA	2.38
Farm Implements, Pump sets, Machinery	0.7275	NA	NA	0.7275
Sub Total				**24.9875**

Table 11-4: *Estimated Overall Agricultural Damage Costs in Wayanad District (in Crore)*

Table 11-5: *Economic Loss (Crop Lost)*

Cropping Pattern	Type	Damaged Area in (Ha)	Productivity (kg per ha)	Total Quantity (in kg)	Unit Price (per kg)	Economic Life Span (Year)	Total Cost (in Crores)
Annual Crops	Ginger	10	4479	44790	98		0.438942
	Banana	20	9432	188640	32.33		0.60987312
	Tuber	50	47127	2356350	15.66		3.6900441
	Vegetables	5	939	4695	39.5		0.01854525
Perennial Crops	Coffee	100	798	79800	208.33	20	33.249468
	Cardamom	100	526	52600	1866.67	7	68.7307894
	Pepper	75	409	30675	662.5	10	20.3221875
	Coconut	5	6228	31140	13.16	30	1.2294072
	Areacanut	10	1068	10680	195	15	3.1239
	Fruit plants (papaya)	30	5970	179100	15	2	0.5373
	Tea	200	1864	372800	14.08	30	15.747072
	Jack	10	2670	26700	100	10	2.67
	Nutmeg	2	634	1268	205	15	0.38991
	Cocoa	4	1284	5136	30	10	0.15408
	Mango	5	6206	31030	30	10	0.9309
Grand Total							**151.84**

Items	Quantity (Kg)	Price (Rs/Kg)	Total Damage Estimate t(In Crores)
Coffee	7,000	208.33	0.145831
Cardamom	60	2,000	0.012
Black Pepper	6,000	662.50	0.3975
Arecanut	3,000	222	0.0666
Turmeric	12	150	0.00018
Grand Total			**0.62**

Table 11-6: *Estimated Losses of Stored Agricultural Products*

Economic Losses in the Sector

Based on the data presented in ***Table 11-5***, the total economic loss was estimated at INR 151.84 Crs. This figure encompasses damages to a variety of crops, including both annual crops (such as banana, ginger, tubers, and vegetables) and perennial crops (like cardamom, black pepper, tea, coffee, nutmeg, coconut, areca nut, jack, mango, and other fruit plants). Additionally, the losses incurred due to damaged stored products are included in this estimate.

11.4. Loss of Stored Agricultural Products

Farmers in Wayanad often store agricultural produce, such as pepper, coffee, and cardamom, in anticipation of favourable market conditions. Due to the recent landslide, many stored products were lost. These losses included 7,000 kilograms of coffee (valued at INR 1,458,310), 60 kilograms of cardamom (INR 120,000), 6,000 kilograms of black pepper (INR 3,975,000), 3,000 kilograms of areca nut (INR 666,000), and 12 kilograms of turmeric (INR 1,800). In total, these losses amounted to INR 62 lakhs.

A detailed breakdown of the economic losses incurred by farmers in Wayanad due to damaged stored agricultural products is provided below:

Loss of Livelihood

Three Estates were ravaged by the landslide affecting the livelihood of 409 workers at a cost of 18.4 Crs.

	No. of estates affected	Employment Lost (Nos.)	Wage Loss (in Crores)
Plantation Workers (Permanent Employees)	3	394	17.37
Plantation Office Staff (Permanent Employees)	3	15	1.03
Total	**3**	**409**	**18.40**

Table 11-7: *Loss of Livelihood (Plantation Workers)*

Category	Total Cost Estimate (in Crore)
Economic Loss (Crop Lost)	151.84
Estimated Losses of Stored Agricultural Products	0.62
Loss of Livelihood of Estate Workers	18.4
Grand Total	**170.86**

Table 11-8: *Overall Loss Estimate*

Socio-economic impacts on affected communities

The landslide in Wayanad has had significant socioeconomic consequences for the local population, who primarily rely on homestead farming for their livelihoods. This traditional agricultural practice provides food security and nutritional support for farm families. Homesteads typically cultivate diverse crops, including tree crops, and often integrate livestock and poultry farming. Many farmers have recently adopted modern agricultural techniques such as terrace gardening and vertical farming.

It is estimated that a total of 750 homesteads were affected by the landslide. In addition to the direct damage to agricultural land, the disaster has resulted in losses related to industrial production, tourism revenue, and forest productivity. The landslide has also negatively impacted real estate values in threatened areas, water quality in local streams and irrigation facilities, and human and animal productivity due to injuries, deaths, and psychological trauma. The landslide has hindered farmers' and agricultural labourers' access to their fields, leading to further losses in agricultural production due to delayed harvesting of crops like cardamom.





Figure 11-4: *Loss of agriculture (in the community habitat area) - Meppadi landslide site*

Loss of Livelihood and Agricultural Production

- **Homestead Farming:** The landslide significantly impacted the livelihoods of farmers engaged in homestead farming, a primary source of income and food security for many families.
- **Crop Damage:** The destruction of agricultural land, including crops like cardamom, directly affected farmers' ability to cultivate and harvest produce.
- **Delayed Harvesting:** Restricted access to fields due to the landslide led to delays in harvesting, resulting in further losses.
- **Economic Losses:** The combined effects of crop damage and delayed harvesting contributed to substantial economic losses for farmers

Impact on Infrastructure and Resources

- **Infrastructure Damage:** The landslide damaged essential infrastructure, such as roads and irrigation facilities, hindering access to agricultural land and affecting water resources.
- **Environmental Degradation:** The disaster caused soil erosion, sedimentation, and pollution of water bodies, impacting the long-term sustainability of agricultural practices.
- **Real Estate Losses:** Property values in areas affected by the landslide declined, affecting the overall economic well-being of the community.

Social and Psychological Impacts

- **Fear and Reluctance:** The landslide instilled fear and reluctance among farmers and agricultural labourers to return to their affected areas, impacting their mental health and willingness to continue their work.
- **Injuries and Deaths:** The disaster may have resulted in injuries or deaths, leading to further trauma and economic hardship for affected families.
- **Psychological Distress:** The sudden loss of livelihoods, property, and a sense of security can have severe psychological consequences for the affected population.

Challenges in Recovery and Rehabilitation

- **Age and Experience:** Many farmers in the affected region are older, which may challenge their ability to recover and adapt to the new circumstances.
- **Lack of Insurance Coverage:** Many farmers' lacks of crop insurance coverage limited their access to financial assistance during recovery.
- **Government Support:** The state government's role in providing timely and adequate support for affected farmers is crucial for successful recovery.

Table 11-9: *Beyond the Physical Damage: The Socioeconomic Toll - Summary*

This is particularly detrimental for the region, which relies heavily on agriculture, including cash crops. Moreover, the fear and reluctance of agricultural labourers to return to the affected area have compounded the challenges the local community faces.

Most farmers in the affected region are over forty, a factor that must be considered in rehabilitation efforts. Additionally, many farmers in this area are unfamiliar with or uninterested in crop insurance, which limits their access to financial support in the aftermath of natural disasters.

To address the significant losses suffered by the farming community, the state government may consider implementing compassionate measures to provide compensation and support for recovery efforts.

11.5. Reconstruction and Recovery Needs Assessment

Soil Degradation and Rehabilitation

Due to severe soil degradation, field observations indicate that restoring agricultural activities in the affected areas will be challenging.

	Small and Marginal Farmers (SMF) (Ha)	Non-SMF (Ha)	Total (Ha)
Wayanad	359	267	626
Sub-Total	**359**	**267**	**626**

Table 11-10: *Agricultural Land Use in Wayanad District (SMF and Non-SMF area)*

Sub-Sector	Damage (Crore)	Losses (Crore)	Total (Crore)
Components of Damage	24.98	0	24.98
Components of Losses	0	170.86	170.86
Total Damage + Loss (In Crores)			**195.84**

Table 11-11: *Agricultural Damage and Losses Components in Wayanad District*

Erosion, debris accumulation, and disruption of soil properties have compromised the land's native fertility. Promoting soil rejuvenation and restoring its humus content is essential to revitalise agricultural productivity.

Agricultural Rehabilitation Strategies

Soil fertility must be prioritised to facilitate agrarian restoration. Soil testing for physical, chemical, and biological attributes is recommended. Implementing sustainable agricultural practices such as cultivating bamboo, reeds, vetiver, and cane in river embankments and pandanus (locally known as "*Kaitha*") in affected areas can contribute to soil health.

Additionally, planting fodder crops like Congo signal, Guinea grass, and Hybrid Napier in fallow lands can enhance soil fertility and provide forage for livestock.

Hands-on training in agricultural production, including nursery management, organic manure production, mushroom cultivation, and apiculture, can empower farmers with the necessary skills for sustainable farming practices.

Cost Estimates for Reconstruction and Recovery

The agricultural sector reported losses of approximately INR 195.84 Crs. The estimated cost for restoration and recovery is INR 25,366,690 per ward, as detailed in ***Table 11-3***.

The total restoration and recovery cost for the three affected wards is estimated at INR 76.08 Crs.

While certain activities suggested for recovery may indirectly support reconstruction efforts, they do not strictly adhere to the conventional definition of reconstruction.

Recovery Cost Breakdown

The total recovery cost is estimated at INR 128.23 Crs. This includes compensation for crop losses (based on NABARD unit costs), land compensation (based on fair value), reclamation costs, and other proposed agricultural activities.

Compensation:

- **Crop Loss:** INR 24.26 crores, calculated based on NABARD unit costs.
- **Land Compensation:** INR 26.08 crores, based on fair market value.

Reclamation:

- INR 1.81 crores for restoring damaged land.

Proposed Activities:

- INR 76.08 crores, covering various agricultural recovery and development initiatives.

Proposed Activities:

- **Cultivation:** INR 81.475 lakhs for homestead farming, vegetable cultivation, coffee, exotic fruits, and deep-rooted crops.
- **Facilities:** INR 20.72 lakhs for marketing, standard facilities, nurseries, polyhouses, and mini weather stations.
- **Income-Generating Units:** INR 47.4 lakhs for activities like mushroom cultivation, vermicomposting, biochar production, hydroponics, and microgreen units.
- **Human Resource Development (HRD):** INR 21.5 lakhs for forming farmer interest groups and engaging household agencies.

The total recovery cost estimate of INR 128.23 crores reflects the comprehensive efforts required to restore agricultural livelihoods and infrastructure in the affected areas.

By carefully assessing the specific needs of farmers in each ward, suitable rehabilitation sites can be selected. Implementing these proposed activities and providing necessary support will enable the region to recover from the devastating effects of the landslide.

Table 11-12: *Beyond the Damage: Recovery Cost - Summary*

The proposed activities, which can be replicated across the affected wards, amount to INR 76.08 Crs (INR 25.36 Crs. per ward) and include costs for human resource development (HRD), cultivation of various crops, inputs, income-generating units, and facilities.

The ward-wise breakdown of costs includes INR 81.475 lakhs for cultivation (homestead, vegetables, coffee, exotic fruits, and deep-rooted crops), INR 20.72 lakhs for facilities (marketing, standard facilities, nurseries, poly houses, mini weather stations), INR 47.4 lakhs for other income-generating units (mushroom, vermicompost, biochar, hydroponics, microgreen units), and INR 21.5 lakhs for HRD (formation of farmer interest groups, engaging household agencies).

These activities can be implemented by selecting suitable rehabilitation sites based on the specific needs of farmers in each ward. Combining the estimated costs for crop loss compensation (INR 24.26 Crs.), land compensation (INR 26.08 Crs.), reclamation (INR 1.81 Crs.), and the proposed activities (INR 76.08 Crs.), the total recovery cost estimate is INR 128.23 Crs.

Impact of Recovery

Table 11-13: *Reconstruction and Recovery Cost Estimates*

Sl. No.	Particulars	Unit Cost (INR in lakhs)	Area/ Quantity/ Agency (Per ward)	Total Cost (In Crores)
Reconstruction Cost Estimates				
1	Homestead Cultivation (5 cents) - Coconut, Banana, Medicinal Plants, etc.	00.05	150 nos.	0.075
2	Cultivation of Vegetables (10 acre) - Precision Farming & Modern Technologies	2.50/acre (season)	10 acres (3 seasons)	0.4
3	Coffee plantation (15 acre) - Irrigation facilities - Maintenance	1.0/acre 0.75/acre 0.45/acre	15 acre	0.15 0.1125 0.0675
4	Exotic Fruits & Deep-Rooted Plants (6 ha) - Maintenance	0.045/acre 0.02/acre	15 acres	0.00675 0.0030
5	Nursery Preparation - Maintenance	3.00/acre 2.00/acre	1 acre	0.03 0.02
6	Poly House - Infrastructure, Seeds, Seedlings & Maintenance	0.02/sq. m 0.01/sq. m	400 sq. m	0.08 0.04
7	Mushroom Unit	0.5/unit	10 unit	0.05
8	Common Facility Center (CFC) & Value Addition Building	2000/unit	1 unit	20
9	Marketing Centre	50.00	1 unit	0.5
10	Mini Weather Station & Maintenance (5 years)	2.5/unit 0.50/year	1 unit Five years	0.025 0.025

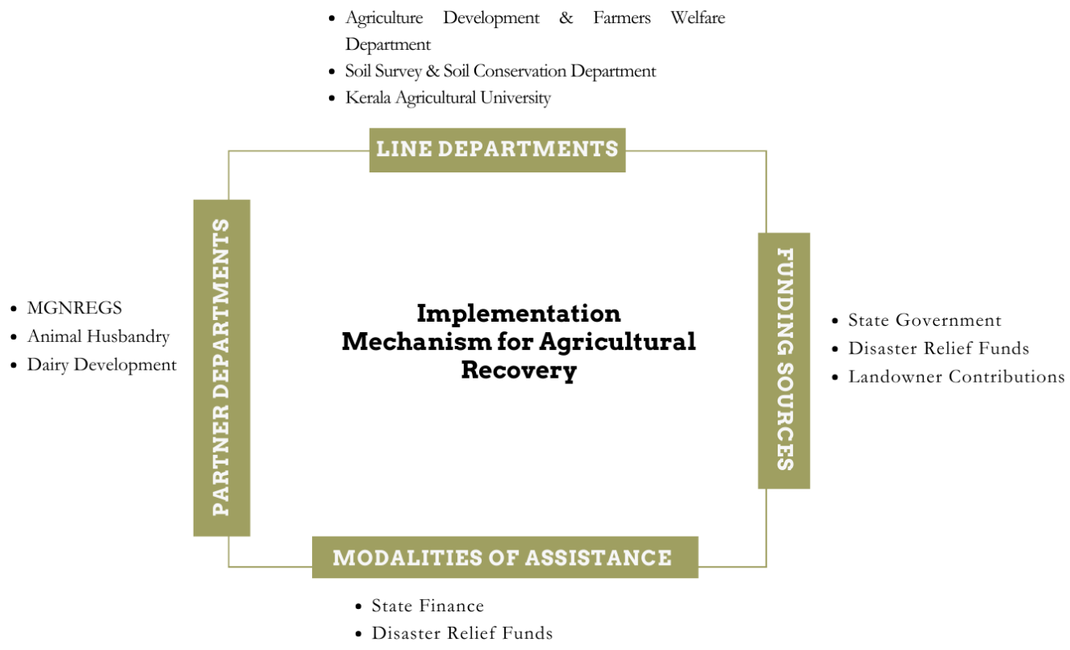
Sl. No.	Particulars	Unit Cost (INR in lakhs)	Area/ Quantity/ Agency (Per ward)	Total Cost (In Crores)
Reconstruction Cost Estimates				
11	Bamboo & Biochar Unit (2 ha) gaseous technology unit	10.00	1 unit	0.1
12	Hydroponics Units (2 units)	10.00	Two units	0.2
13	Microgreen Units	5.00	Two units	0.1
14	Vermicompost Units	0.60	Four units	0.024
Sub Total (for 1 ward)				**22.00875**
Recovery Cost Estimate				
1	Formation of Farmer Interest Groups (FIGs) & Support Activities (through KABCO * Engaging Handholding Agency (3 years) 1. Farmer organisation & Awareness 2. Feasibility studies 3. Business Plan preparation (FPO/FCs) 4. Common Facility Center (CFC) formation 5. Value chain & marketing programs 6. Conducting B2B conclave 7. Other FPO/FC formation activities 8. Working capital	200.00 0.10	Kerala Agro Business Company (KABCO) 150 nos.	2 0.15
2.	Contingency fund	5%		1.20
Sub Total (for 1 ward)				**3.3579**
Total for one ward (in crores)				**25.36**
Total for three wards (in crores)				**76.08**
Additional Recovery Measures				
Compensation of crop loss (based on NABARD unit cost)				24.26
Compensation for land (based on fair value)				26.08
Reclamation cost				1.81
Grand Total of Reconstruction and Recovery Cost Estimate (in Crores)				**128.23**

The proposed skill training programs are expected to enhance farming practices and increase yields, production, and product quality. This improvement in agricultural productivity will enable farmers to achieve higher incomes than pre-disaster levels.

Within the context of Farmer Interest Groups (FIGs), women, particularly tribal women, should be prioritised. Forming Tribal Women Groups (TWGs) can foster the development of specific skills and encourage the production of diverse products, including processed food items and handicrafts. Exclusive branding and labelling initiatives can enhance the market value of these products. Additionally, providing mobile marketing facilities can expand market opportunities for branded and labelled products, contributing to a “build back better” strategy.

Raising awareness about crop insurance schemes is crucial to ensure economic security during future disasters. Particular attention should be given to this sector to facilitate access to and benefit from various insurance programs.

Figure 11-5: *Implementation Mechanism for Agricultural Recovery*





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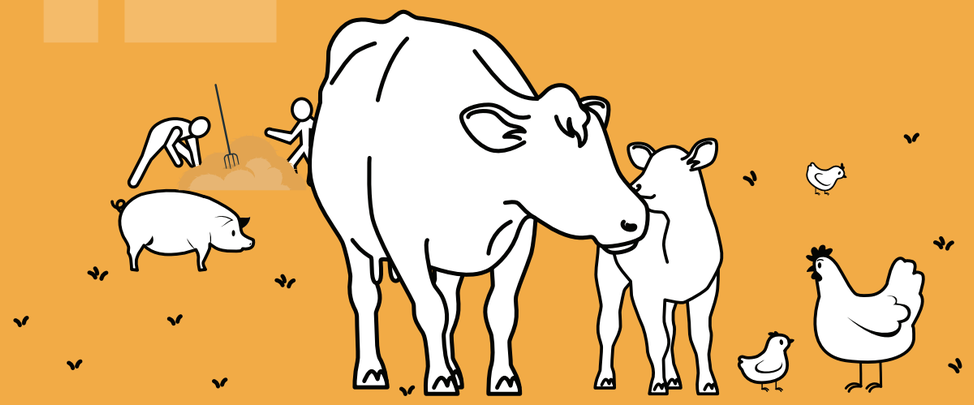


Animal Husbandry and Livestock

12.1. Basic Profile of the Sector

In Kerala, the livestock sector has emerged as a vital and rapidly growing component of the rural economy, significantly contributing to the state's agricultural output. According to the National Accounts Statistics (NAS) 2022, the livestock sector's contribution to the total agriculture and allied sector Gross Value Added (GVA) at constant prices increased from 29.33 per cent in 2019-20 to 30.13 per cent in 2020-21. Nationally, the livestock sector accounted for 4.90 per cent of the total GVA in 2020-21.

In Kerala, the livestock sector's contribution to the total agriculture and allied sector Gross State Value Added (GSVA) at constant prices (2011-12) was 26.44 per cent in 2021-22, representing a share of 2.35 per cent in the state's total GSVA. In real terms, GSVA in the livestock sector at constant prices (2011-12) marginally increased from INR 11,701,86 Crs. in 2020-21 to INR 11,714,01 Crs. in 2021-22.

Kerala's total milk requirement in 2021-22 was 33.51 lakh metric tonnes, while annual production was only 25.79 lakh metric tonnes, resulting in an average outside purchase of over 2.5 lakh litres of milk daily. Of the total milk produced in the state, 93.56 per cent came from crossbred cattle, with Indigenous cattle contributing a negligible 0.0661 lakh metric tonnes. Non-descript cattle produced 0.3117 lakh metric tonnes, and goats contributed 1.34 lakh metric tonnes. The remaining milk production was from indigenous and non-descript buffaloes.

Wayanad, a district renowned for its hilly terrain and rich biodiversity, has a robust agricultural base where animal husbandry and livestock farming play a pivotal role in the local economy. The district ranks second in terms of milk production in the state. Dairy farming is a prominent activity, with numerous small-scale farmers involved in milk production, often rearing indigenous and crossbred cattle. Poultry farming is also widespread, providing a significant source of income for rural households. There is a growing interest in organic and free-range poultry practices.

A well-organized network of dairy farms and cooperatives characterises the dairy sector in Wayanad. With over 19,000 farmers actively engaged in dairy farming, the sector supports livelihoods and contributes substantially to the local economy. The district has 56 dairy cooperative societies that are crucial in milk procurement, processing, and distribution. These cooperatives ensure that the high milk production in the region, averaging around 2.5 lakh litres per day, is efficiently collected and marketed. The sector is driven by the active participation of farmers, cooperatives, and private players, all working together to sustain and grow Wayanad's dairy industry.

In Meppadi Grama Panchayat, 1,782 registered dairy farmers are affiliated with various dairy cooperative societies, with 435 actively supplying milk. In the affected area of Chooralmala, within the Meppadi Grama Panchayat, the Chooralmala Dairy Cooperative Society is a vital institution, contributing significantly to the livelihoods of local farmers.203 farmers are registered with the dairy cooperative society, although only 50 are actively engaged in supplying milk.

Goat farming, particularly of the Malabari breed, is well-suited to Wayanad's climate and popular among the locals. While sheep farming is less common, it is still practised in some areas primarily for meat production. Pig farming also contributes to the local economy, particularly within specific communities.

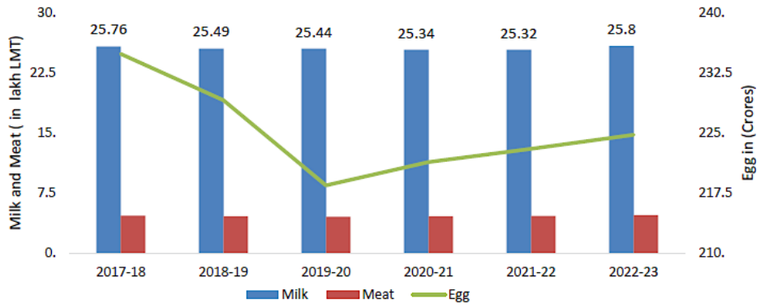
The district benefits from a network of veterinary services, including hospitals and clinics, providing essential livestock healthcare. Government-conducted vaccination drives and health check-ups help prevent disease outbreaks. Sustainable and organic farming practices are increasingly adopted, with integrated farming systems combining livestock with crop cultivation being common.

Government support through subsidies, veterinary care, breeding programs, and training on modern livestock management helps boost productivity. However, challenges like disease outbreaks, limited access to advanced veterinary care, and fluctuating market prices persist. The district's hilly terrain and remote locations can also hinder access to resources and markets. Despite these challenges, livestock farming remains vital to Wayanad's agrarian economy, providing livelihood opportunities to a large section of the rural population and complementing the district's agricultural activities.

	Cow	Buffalo	Rabbit	Poultry	Goat	Pig	Total Livestock (poultry not included)
Meppadi (Grama Panchayat)	1743	104	289	22455	1387	160	3683
Wayanad (District)	79750	4354	3978	889128	45350	9147	1,42,579

Table 12-1: *Animal Husbandry and Livestock: Profile (20th National Livestock Census)*

Livestock Asset Value



Source: Kerala State Animal Husbandry Department, GoK 2022

Service Departments (Department of Animal Husbandry, Department of Dairy Development)

The Department of Animal Husbandry in Kerala plays a pivotal role in promoting the growth and sustainability of the livestock sector. Through its comprehensive veterinary services, infrastructure development, and training programs, the department aims to ensure the health, productivity, and welfare of livestock and poultry. By focusing on disease prevention, treatment, and surveillance, the department contributes to the efficient production of essential commodities like milk, meat, and eggs, ultimately enhancing food security and economic growth for the state's rural communities.

The Department of Dairy Development is dedicated to fostering the development of the dairy sector in Kerala. By promoting sustainable dairy farming practices, improving milk production, and ensuring the quality and safety of dairy products, the department seeks to enhance the livelihoods of dairy farmers and provide consumers with a steady supply of high-quality dairy products. The department's focus on capacity building, cooperative development, and infrastructure enhancement aligns with these objectives.

Both departments contribute significantly to addressing unemployment and underemployment in rural areas by creating job opportunities in animal care, breeding, and related services. The government's support through veterinary services, subsidies, and training programs further underscores these sectors' importance in improving the rural population's living standards and sustaining Wayanad's agrarian economy.

Overall, the animal husbandry sector in Wayanad is vital to the district's economy, supporting livelihoods, encouraging sustainable farming practices, and contributing significantly to its development. The concerted efforts of the Department of Animal Husbandry and the Department of Dairy Development are instrumental in ensuring the growth and sustainability of this sector.

Importance of Animal Husbandry in Kerala

Kerala's animal husbandry and dairy sector is pivotal in the state's socioeconomic development. Its significance can be highlighted in the following key areas [***Table 12-2***]:

12.2. Sectoral Policies

The Department of Animal Husbandry and Dairy Development in Kerala has implemented various schemes and programs to strengthen the livestock sector, enhance livelihoods, and promote long-term recovery for farmers and rural communities. These initiatives are tailored to Kerala's specific geographical and socioeconomic conditions and prioritise sustainable

Table 12-2: *Animal Husbandry and Socioeconomic Growth in Kerala*

Economic Contributions

- **Income Generation:**Provides a regular income source for farmers by selling livestock products.
- **Employment Opportunities:** Creates jobs for small and marginal farmers, landless labourers, and related industries.

Food Security and Nutrition

- **Essential Nutrients:** Contributes to food security by providing essential nutrients like protein, vitamins, and minerals.

Social and Economic Impacts

- **Women's Empowerment:** Empowers women by providing income-generating opportunities.
- **Community Development:** Supports dairy cooperatives and fosters community-based development

Environmental Benefits

- **Sustainable Agriculture:** Promotes sustainable farming practices through integrated farming systems.
- **Biodiversity Conservation:** Preserves indigenous livestock breeds, contributing to biodiversity and resilience.

Economic Growth

- **Value-Added Products:** Contributes to the production of value-added products with export potential.

livestock farming, improved animal health, and increased productivity.

Key Initiatives:

- **Cow Cross Breeding:** The Kerala State Livestock Development Board (KLDB) supports a cattle cross-breeding program that involves breeding local breeds with exotic breeds like Holstein Friesian (HF) and Jersey through Artificial Insemination (AI). This program aims to enhance milk production, improve adaptability to the local climate, and increase disease resistance.

- **Veterinary Services:** A wide network of Artificial Insemination Centers and veterinary institutions provides essential services in rural areas of Wayanad, ensuring quality treatment and veterinary care.

- **Special Livestock Breeding Program (SLBP):** This program offers subsidies for providing nutritious feed to female calves, aiming to reduce the calving age to 2.5 years.

- **National Livestock Mission Schemes:** The district has previously implemented National Livestock Mission Schemes for goats and animal insurance.

- **Layer Bird Distribution Schemes:** These schemes, supported by Local Self Governments (LSGDs), were implemented to enhance household egg production.

The following table presents a comprehensive overview of key schemes and programs implemented by the departments, which are essential for fostering resilience and sustainable growth in the areas of animal husbandry and livelihoods within Kerala.

Table 12-3: *Animal Husbandry and Livestock: Profile (20th National Livestock Census)*

Sl. No	Scheme/ Programme	Description
1	Veterinary and Animal Health care services	Provides comprehensive veterinary care for both production and pet animals.
2	Special Livestock Breeding Programme	Offers subsidised feed to selected calves to enhance their growth, immunity, breeding, and future production capacity.
3	Animal Insurance Scheme	Farmers could insure their animals at subsidised premium rates with government support, providing financial protection against losses due to diseases, accidents, and natural disasters. These insurance schemes helped alleviate the economic burden on farmers and encouraged responsible livestock management practices.
4	Rashtriya Gokul Mission (RGM)	The Kerala Livestock Development Board (KLDB) has implemented various training programs to enhance the skills of veterinarians and artificial insemination technicians. These initiatives aim to improve breeding practices and policies within the state.
5	Rural Dairy Extension and Advisory Services	The program aims to empower dairy farmers, particularly those in rural areas, by providing them with the necessary knowledge, skills, and resources to enhance their dairy farming practices and increase animal productivity.
6	Production and conservation of fodder in farmer fields and dairy co-operatives	The program supports farmers and co-operative societies in establishing fodder farms and implementing mechanisation techniques to ensure a consistent supply of high-quality fodder for livestock throughout the year.
7	Milk Shed Development Programme (MSDP)	The program aims to increase milk production by offering subsidies for purchasing high-yielding dairy animals, investing in infrastructure improvements for dairy farms, and modernising and mechanising dairy farming operations.
8	Cattle Feeding Subsidy Scheme	The program focuses on distributing green grass, silage, Total Mixed Ration (TMR), and other dried feed components and mineral mixtures to dairy farmers at subsidised rates through dairy cooperatives.
9	Strengthening Quality Control Labs	The program aims to enhance milk's physicochemical and microbiological quality and ensure a robust cold chain mechanism to implement a comprehensive Total Quality Management system from farm to fork.
10	Assistance to Dairy Cooperative Societies	The program aims to provide adequate infrastructure facilities for dairy cooperative societies (DCSs) to efficiently procure, handle, store, and process high-quality milk, ensuring food security and safety.
11	Kerala Dairy Farmers Welfare Fund Board	The program offers dairy farmers financial support and welfare benefits, including pensions, insurance, educational scholarships, and emergency financial assistance.
12	National Livestock Mission (Goat)	The subsidy scheme provides financial support for purchasing 10 does and 1 buck. Goat rearing is a profitable venture that offers high returns from milk and meat production, particularly for farmers in rural communities.
13	Goat Satellite Scheme	The subsidy scheme offers financial support for individuals who meet specific criteria to purchase 5 does and 1 buck. This initiative aims to increase milk and meat production, providing livelihood opportunities for small-scale farmers.

[Source: Animal Husbandry and Dairy Development Department]

12.3. Damages in the Sector

The Meppadi landslides in 2024 had a devastating impact on the region's animal husbandry and livestock. Approximately 226 cattle and 165 goats perished in the landslides, particularly in Chooralmala and Mundakkai. The disaster not only claimed human lives but also severely affected livestock, which are vital to the livelihoods of local farmers. Rescue efforts were hampered by heavy rains and difficult terrain, making it challenging to reach affected areas. A private cattle farm in Punchirimattom, with about 20 surviving cattle, remained inaccessible due to these conditions. The lack of statistics on other livestock losses, such as poultry, added to the challenges faced by the affected communities.

The landslides had a broader impact on agriculture and livestock, highlighting the region's vulnerability to natural disasters. Climate change and human interventions like deforestation and unplanned construction have exacerbated this vulnerability. The loss of livestock represents a direct economic loss for the affected families and impacts the overall agricultural productivity of the region, which is heavily dependent on animal husbandry. While not directly damaged, the Dairy Cooperative Society in Chooralmala experienced significant disruption in its operations due to a decline in the local animal population. This reduction affected milk procurement and sales, leading to operational challenges and financial strain on the cooperative.

Severe challenges marked post-disaster, such as the conditions of farmers in Chooralmala. Many farmers were left homeless, having lost family members and valuable assets. The destruction of crops and loss of livestock led to significant economic hardships and food insecurity. Soil erosion and land degradation further reduced agricultural productivity, making recovery difficult. Damage to critical infrastructure, such as roads and irrigation systems, isolated farmers from markets and essential services. Many farmers faced debt and economic instability due to loss of income, while mental and physical health issues rose due to stress, grief, and the labour-intensive recovery process.

The plight of animals was equally dire. Many livestock, including cattle, goats, and poultry, were either killed or severely injured due to landslides and floods. Surviving animals faced a fodder shortage and clean water, leading to malnutrition, diseases, and decreased productivity. The collapse of animal shelters and lack of proper veterinary care further compounded the suffering of these animals. Farmers, already overwhelmed with personal losses and displacement to relief camps, struggled to provide adequate care and shelter for their surviving animals.

12.4. Structural Damages – Animal Husbandry & Dairying

The landslides and heavy rains in Chooralmala severely damaged many cattle sheds, resulting in significant losses for the local farmers. The animal shelters were destroyed, and essential utensils and dairy farming equipment, such as milking machines, feeding troughs, and storage containers, were also lost. These losses have

	Cow	Buffalo	Goat	Poultry	Rabbit
Total (Meppadi Grama Panchayat)	1743	104	1387	22455	289
Damages	226	12	165	1032	26

Table 12-4: *Animal Husbandry Damages (No.)*



Figure 12-1: *Affected free-range animals & poultry from the Meppadi landslide site*







Figure 12-2: *Deceased animals from the Meppadi landslide site*

Table 12-5: *Animal Husbandry and Livestock Damage and Replacement Cost (crore)*

	Cow	Buffalo	Goat	Poultry	Rabbit
Total Damages	226	12	165	1032	26
Damage Cost	100000	120000	15000	300	1000
Grant Total (INR)	**2,26,00,000**	**14,40,000**	**24,75,000**	**3,09,600**	**26,000**
Damages and Replacement Cost (AH & DD) = INR 2.68 crores					

further compounded the challenges faced by the farming community, disrupting daily operations and affecting milk production and income generation.

The destruction of infrastructure and essential farming tools highlights the urgent need for comprehensive relief and recovery measures to rebuild resilient cattle sheds, replace lost equipment, and restore normalcy for the affected dairy farmers in Chooralmala.

12.5. Economic Losses in Animal Husbandry and Dairying

The Chooralmala disaster inflicted substantial economic losses on the animal husbandry and dairy sectors, significantly impacting the livelihoods of local farmers. Landslides and heavy rains led to the complete or partial destruction of cattle sheds, resulting in the loss of livestock and immediate financial hardships. Farmers also suffered losses of essential dairy farming equipment and utensils, disrupting daily operations and milk production. The scarcity of fodder and feed and the need for emergency veterinary care added to the financial strain. Moreover, the inability to access markets due to damaged infrastructure led to distressed livestock sales at low prices, further reducing income.

These cumulative losses highlight the urgent need for targeted recovery efforts to restore the economic stability of affected farmers and rebuild the local animal husbandry and dairy industries.

Beyond the primary loss of livelihood from animal husbandry and dairy farming, many farmers in Chooralmala who were engaged in alternative income sources faced further economic setbacks. Farmers involved in the tourism sector, handicrafts, preparation and sale of traditional food and delicacies, and plantation labour were severely impacted by the disaster. The disruption caused by landslides and heavy rains led to a decline in tourism, damaged handicraft workshops, halted the production and sale of local delicacies, and affected plantation work, resulting in a loss of supplementary income streams. This compounded their financial burden, leaving them with limited means to recover from the disaster and increasing their vulnerability in the face of such calamities. The loss of both primary and alternative livelihoods highlights the critical need for comprehensive support measures to help these communities rebuild and diversify their income sources to ensure long-term resilience and economic stability.

To accurately assess the economic losses in the animal husbandry and dairy sectors due to the Chooralmala disaster, the following criteria should be taken into account [***Table 12-6***]:

These criteria offer a comprehensive framework for evaluating the economic impact of the disaster on the animal husbandry and dairy sectors, providing a detailed understanding of losses and guiding effective recovery and support measures for the affected communities in Chooralmala.

Table 12-6: Assessing Economic Losses in Chooralmala: A Comprehensive Framework

Livestock Losses

- **Cows:** Economic valuation based on age, body size, milk production capacity, lactation period, and gestation stage at the time of loss.
- **Buffaloes:** The value of buffaloes can be assessed by the market price of the meat yield, breeding capacity, and health condition.
- **Goats:** Valuation based on age, body size, milk production potential, lactation period, and gestation stage.
- **Poultry:** Assessment based on body weight and egg production rates to estimate the loss of meat and egg output.
- **Rabbits:** Losses calculated considering body weight and age influence their market value and reproductive potential.

Fodder Losses

- Assessment based on the area under fodder cultivation, the stage of growth at the time of loss, and the variety of fodder grown. These factors determine the yield potential and economic value of the fodder crop.

Cattle Shed Damage

- Economic losses are calculated based on the area of the cattle shed affected, the type of construction material used (e.g., wood, concrete), and the extent of damage (complete or partial).

Loss of Equipment and Utensils

- Valuation is based on the market value of essential dairy farming equipment and utensils lost or damaged, such as milking machines, feeding troughs, and storage containers.

Losses in Dairy Cooperatives

- Assessment of losses in milk procurement by dairy cooperatives, calculated based on the reduction in the quantity of milk procured and the prevailing market rate for milk.

Indirect Losses in Additional Livelihoods

- Estimation of indirect losses related to alternate livelihood sources like tourism, handicrafts, traditional food preparation, and plantation labour. Calculated based on the number of lost man-days and average daily wages, reflecting the broader economic impact on households that depended on these income streams.

Table 12-7: Animal Husbandry and Livestock - Economic Losses in AH & DD (In crores)

	Cow	Buffalo	Goat	Poultry	Rabbit
Loss cost	3,41,600	1,20,000	30,000	1800	1000
Total Loss (INR)	7,72,01,600	14,40,000	49,50,000	18,57,600	26000
Economic Losses – INR 8.54 Crs.					

Methodology for Calculation: Damage & Losses Rates – Animal Husbandry and Livelihoods Economic Losses

Animal/Poultry	Average adult animal/poultry Weight/ Age/Milk	Replacement Cost (INR)
Cow	Average adult cow with 20L of milk yield at INR 5000/L of milk.	1,00,000
Buffalo	Average adult buffalo with meat yield of 250-300 kg at INR 400/kg of meat.	1,20,000
Goat	Male – 15000, Female – 14000 (Market value of goats)	15,000
Poultry	Layer – INR 200-300, Broiler – INR 150-250	300
Angora Rabbit	Average rabbit with meat yield of 2 kg at INR 500/kg of meat	1000
# Replacement Costs are on a higher end as the economic impact of the disaster extends beyond tangible losses and includes significant intangible costs such as trauma and emotional distress.		

Table 12-8: Animal Husbandry and Livestock: Unit Cost assumption for replacement cost

Economic Losses

Livestock / Poultry	Annual Income (INR)	Explanation
Cow	3,41,600	A high-yielding lactating cow, capable of producing 20 litres of milk per day for a lactation period of 305 days, was sold at a price of INR 56 per litre.
Buffalo	1,20,000	An average adult buffalo yielded 250-300 kg of meat, valued at INR 400 per kilogram
Goat	30,000	Goats are known to have two breeding cycles per year, resulting in the birth of 2-3 kids in each cycle. These kids can be sold at an average price of INR 5,000 per kid. Additionally, the adult goat's meat can be valued at INR 750 per kilogram. Assuming a typical adult goat yields 20 kilograms of meat, the total value of a goat (including the value of its kids) is INR 45,000.
Poultry	1,800	Hens produce an average of 250-300 eggs per year, selling for INR 6 per egg.
Rabbit	1,000	Rabbits typically yield 2 kilograms of meat, which sells for INR 500 per kilogram.

Table 12-9: *Animal Husbandry and Livestock - Methodology for Assumption of Economic Loss*

Socio-Economic impact on People

The Chooralmala disaster has devastated the local community, particularly those engaged in animal husbandry and dairy farming. The landslides and heavy rains resulted in severe losses of livestock, poultry, and essential farming equipment, directly affecting the primary source of income for many households.

A significant portion of the rural population in Chooralmala relies on these sectors for their livelihood. With nearly 75% of households engaged in animal husbandry or dairy farming, the disaster has severely disrupted their daily lives. Recovery will be a lengthy process, requiring the reconstruction of physical assets and the implementation of effective risk mitigation measures.

The infrastructure in Chooralmala was particularly vulnerable to the disaster. Many buildings were located in areas susceptible to landslides and waterlogging, highlighting the need for safer construction practices and land use policies.

However, there are signs of positive change, as the community is becoming more aware of these risks and adopting safer building methods.

The disaster has also exacerbated housing challenges for farmers. Many have lost their homes and live in rented accommodations that may not be suitable for housing livestock. This has further disrupted their livelihoods and added to their financial burdens.

Beyond the tangible losses, the disaster has had a significant impact on the mental health of the affected population. The trauma of losing loved ones and livelihoods has left a lasting psychological impact. The financial strain and uncertainty about the future compound the emotional distress.

In conclusion, the Chooralmala disaster has had a profound socio-economic impact on the local community. Recovery will require rebuilding and addressing the affected population's mental health needs, implementing risk mitigation measures, and promoting sustainable development practices. The community can enhance its resilience and better prepare for future disasters by doing so.

12.6. Response by the Government

The Department of Animal Husbandry and Dairy Development played a pivotal role in the aftermath of the Chooralmala disaster. As an advocate for animal welfare, the department took immediate action to alleviate the suffering of animals affected by the calamity.

A team of veterinary doctors was constituted to provide emergency care and support. A 24-hour helpline was established to assist affected farmers and pet owners. The department also distributed pet food to animals in distress.

The department was actively involved in rescue operations, providing veterinary treatment to injured and sick animals. Regular health monitoring was conducted for orphaned and stray animals. Veterinary doctors from the AH Department played a crucial role in forensic investigations, identifying animal remains during excavation processes.

The team of veterinary doctors ensured regular care for stranded animals at the Vanarani estate farm. The farm was isolated due to the destruction of a bridge, but the veterinary team provided essential veterinary care to the animals. The team also disposed of animal carcasses and disinfected the affected areas.

Simultaneously, the Dairy Development Department provided essential support to affected dairy farmers. The department channelled feeds, fodder, and mineral mixtures to needy farmers. A 24-hour control cell monitored relief activities and coordinated the distribution of feeds under the "Ksheera Ashraya" Programme. The Dairy Development Department closely monitored the activities of the dairy cooperative society in the area. The society resumed operations within three days of the disaster. A temporary camp was set up near the society to provide shelter and care for orphaned livestock. The department ensured a steady supply of feed to address the nutritional needs of these animals.

The Department of Animal Husbandry and Dairy Development demonstrated a strong commitment to animal welfare after the Chooralmala disaster. The department's efforts to provide emergency care, support farmers, and ensure the well-being of animals were instrumental in mitigating the impact of the calamity.

The coordinated efforts of the Dairy Development and Animal Husbandry Departments ensured a comprehensive response to the needs of livestock and their owners. By contributing essential resources, veterinary care, and support, these departments can help stabilize the local dairy industry and protect the livelihoods of the affected farmers.

The District IAG has been at the forefront of the response to the devastating landslide in Meppadi. HSI India, the district's sole animal welfare IAG member, is actively involved in caring for affected animals. Working hand-in-hand with the Department of Animal Husbandry, HSI India have demonstrated the power of government-IAG partnerships.

Further, the District IAG's GO-NGO coordination also facilitated numerous organizations participation in the relief and rescue efforts for animals affected by the landslide.







Figure 12-4: *Feeds were provided to the animals/poultry at the landslide site*









Figure 12-5: *Wayanad IAG member HSI India at the landslide site assisting animals/ poultry affected by the disaster*





Figure 12-6: *(Above) Collection of animal feeds*
(Below) Need assessment surveys conducted by GoK - Department of Animal Husbandry

12.7. Reconstruction And Recovery Needs Assessment

The recent disaster in Chooralmala has profoundly impacted the livestock sector, a cornerstone of the local economy. The region's dairy industry, heavily reliant on cattle husbandry, has been particularly vulnerable. The significant loss of livestock and the destruction of grazing lands and agricultural infrastructure has resulted in a precipitous decline in milk production. This, in turn, has had a cascading effect on the livelihoods of local farmers and the stability of the broader dairy value chain.

The disruption of essential services, including veterinary care, feed distribution, and transportation networks, has further exacerbated the crisis. The combined impact of these factors has led to severe economic hardship for the affected communities, as evidenced by the decline in income from milk, meat, and other animal products.

The cooperative sector, a vital component of the region's agricultural economy, has also been adversely affected. The challenges faced by these cooperatives, including operational difficulties and financial constraints, highlight the urgent need for targeted interventions to support recovery and resilience.

The revitalisation of the livestock sector is essential for the region's economic and social well-being. A comprehensive approach that addresses immediate needs and long-term sustainability is required to ensure the dairy industry's recovery and local farmers' livelihoods.

Building upon a comprehensive assessment derived from field visits, stakeholder interviews, and data analysis, a strategic framework has been developed to guide the reconstruction and recovery efforts in the Chooralmala region. The proposed animal husbandry and dairy sector strategy is centred on restoring damaged assets and implementing innovative measures to enhance resilience and sustainability.

Key components of the recovery plan include the immediate replenishment of livestock populations through targeted financial assistance to farmers. Concurrently, efforts will be directed towards reconstructing damaged cattle sheds and milk collection facilities, incorporating resilient design principles to mitigate future risks. Furthermore, the strategy prioritises the restoration of natural grazing lands, the implementation of advanced fodder management practices, and the development of climate resilient infrastructure.

To enhance the capacity of local farmers, capacity-building and training programs will be provided, focusing on modern dairy farming techniques. Additionally, initiatives to diversify livelihoods through alternative livestock options and integration with eco-tourism activities will be pursued. This multifaceted approach aims to ensure a robust and sustainable recovery of the animal husbandry and dairy sector in Chooralmala.

To strengthen these recovery efforts, innovative schemes will be introduced, including financial incentives for sustainable agricultural practices and the promotion of value added dairy products. Existing government programs, such as those implemented by the Dairy Development Department, Department of Animal Husbandry, Local Self Government Departments, Kerala Cooperative Milk Marketing Federation & Regional Unions, Kerala Livestock Development Board, Kerala State Poultry Development Corporation Ltd., Meat Products of India, Kerala Feeds, National Dairy Development Board, Kerala Dairy Farmers Welfare Fund Board, and others, will be strategically leveraged to optimise resource allocation.

Strategic alliances will be forged between government agencies, community organisations, and relevant stakeholders to facilitate the effective coordination and implementation of recovery initiatives. This comprehensive approach aims to restore the dairy sector's pre-disaster capacity and cultivate a more resilient and diversified agricultural economy in Chooralmala. By prioritising sustainability and innovation, the region can secure long-term economic stability and enhance the livelihoods of the affected communities.

Table 12-10 *Recovery and Reconstruction Need Assessment - Summary*

The Devastation of the Disaster

- **Severe Impact on Livelihoods:**The Chooralmala disaster has dealt a significant blow to the animal husbandry sector, a primary source of income for local farmers.
- **Reduced Livestock and Milk Production:** The decline in cattle, poultry, and natural grazing lands has drastically reduced milk production, impacting farmers' incomes and destabilising the dairy sector.
- **Infrastructure Damage and Supply Chain Disruptions:** Damage to cattle sheds, feed supplies, and transportation routes has further hindered milk collection and distribution.

Economic Setbacks and Operational Challenges

- **Reduced Livelihoods:** The overall reduction in livestock has disrupted the supply of milk, meat, and other animal products, causing severe economic setbacks for farmers.
- **Cooperative Sector Instability:** These challenges have led to operational and financial instability within the cooperative sector, highlighting the urgent need for recovery efforts.

A Comprehensive Recovery Strategy

- **Restoration and Resilience:** The strategy focuses on restoring existing assets and implementing new schemes to enhance resilience and sustainability.
- **Key Initiatives:** Key efforts include restocking livestock, reconstructing infrastructure, improving fodder management, and developing climate-resilient infrastructure.
- **Capacity Building and Diversification:** Training programs will be provided to farmers and initiatives to diversify livelihoods through alternative livestock options and eco-tourism.

* *Continued in the next page*

Leveraging Existing Schemes and Partnerships

- **Financial Incentives and Value-Added Products:** New schemes will be introduced to promote sustainable farming practices and value-added dairy products.
- **Government Program Utilization:** Existing government programs will be leveraged to maximise resources and support recovery efforts.
- **Collaborative Partnerships:** Partnerships between various departments and community organisations will be established for effective coordination.

Building a Resilient Future

- **Sector Revitalization:** The goal is to restore the dairy sector's capacity and build a more diversified agricultural economy.
- **Long-Term Stability:** This will ensure long-term stability and improved livelihoods for the affected communities.
- **Resilience and Sustainability:** Chooralmala can recover from the disaster and thrive in the future by focusing on resilience and sustainability.

Reconstruction and Recovery Cost Estimates

A strategic plan has been developed to ensure a sustainable long-term recovery in Chooralmala. This plan envisions approximately 200 farmers engaging in dairy farming, each managing an average of three cows. Additionally, 100 families are projected to rear 10 goats each, while 50 families will focus on raising five buffalo calves. Furthermore, 200 farmers are expected to rear 100 chicks each, fostering a diversified livestock production landscape.

To support these initiatives, medium-term strategies will prioritise capacity-building and training programs designed to equip farmers with the necessary skills and knowledge for effective livestock management. Infrastructure development is imperative to facilitate the successful implementation of these plans and ensure desired outcomes. This includes the enhancement of veterinary services, the strengthening of cooperative infrastructure, and the establishment of other essential support facilities. This comprehensive approach will not only aid in restoring the livelihoods of the affected communities but also cultivate a more resilient and sustainable animal husbandry sector in the long term.

The designated infrastructure sector will manage the reconstruction costs for infrastructure within the animal husbandry sector. Expenses will be calculated following established norms and guidelines, ensuring that the rebuilding efforts adhere to necessary standards and are adequately funded to support the rehabilitation of the disaster-affected animal-

Figure 12-11: *Reconstruction and Recovery Cost Estimate*

Reconstruction Cost Estimate

Sl. No.	Reconstruction Measures	Cost Estimate (Crore INR)	Timeline	Implementing Agency
1	Veterinary Hospital (including salary for staff	2.5	Long-term	Animal Husbandry Department
2	Mechanisation of Dairy farming (biogas plant, milking machines, equipment and utensils)	3	Long-term	Agricultural University/Department of Science and Technology
3	Feed storage barns/godowns	1	Long-term	PWD
Total Reconstruction Cost Estimate (In Cr)				**6.5**

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Recovery Cost Estimate				
Sl. No.	**Recovery Measures**	**Cost Estimate (Crore INR)**	**Timeline**	**Implementing Agency**
1	Replacement of damaged (livestock and poultry)	2.68	Short-term	Animal Husbandry Department
2	Setting up temporary cattle camps, feed and health management for 60 days	0.1	Short-term	Animal Husbandry Department
3	Emergency Medicine Stocking for Readiness	0.5	Short-term	Animal Husbandry Department
4	Extension Training programs for farmers	0.12	Medium -term	Agricultural University
5	Livestock Breeding Programs			
6	Establishment of satellite piggery units	1.65		
7	Establishment of satellite goat units	1.4	Medium-long term	Kerala Livestock Development Board
	Sub Total	**3.05**		
8	Financial support to future prospective farmers	8.54	Long-term	Dairy Development Department
9	Insurance coverage for livestock	0.5	Long-term	Insurance Companies
10	Dairy Cooperative Society upgradation	2	Long-term	Dairy Development Department
11	Mobile Veterinary Ambulatory Clinic and allied expenses	1	Long-term	Animal Husbandry Department
12	Animal Birth Control Program and immunisation for stray dog population	1	Long-term	Animal Husbandry Department/Local Self-Government
Total Recovery Cost Estimate (In Cr)		**19.49**		
Grand Total of Reconstruction and Recovery Cost Estimate (In Cr)		**25.99**		

husbandry facilities.

Possible impact of Recovery

The resilience of the animal husbandry sector is paramount in mitigating the adverse effects of natural disasters in Chooralmala, Wayanad District. When implemented in conjunction with the recommended reconstruction measures, the proposed recovery interventions will be instrumental in restoring and fortifying the livelihoods of communities heavily reliant on animal husbandry and dairy farming. The planned livelihoods strategy enhances the affected population's resilience, proactively transcending bare recovery and reconstruction efforts.

Informed by insights and lessons gleaned from past disaster events, these strategies emphasise the necessity of sustainable and resilient approaches to rebuild the sector.

Key interventions include the replenishment of livestock populations, the reconstruction and upgrading of infrastructure with resilient designs, the enhancement of access to veterinary services, and the fortification of supply chains for feed and fodder.Furthermore, capacity-building initiatives will equip farmers with the requisite skills and knowledge to effectively manage risks and adapt to future challenges.

The following table outlines the proposed interventions for resilience building within the Animal Husbandry sector in Chooralmala, detailing specific actions, timelines, and required resources.

This comprehensive approach aims to ensure a sustainable and robust recovery, ultimately leading to a more resilient and disaster-resistant animal husbandry sector in the region.

Figure 12-12: *Recovery Interventions*

Sl. No.	**Initiative**	**Description**
1	Animal Husbandry and Dairy Development Department	A comprehensive risk assessment focused on animal husbandry and livestock is imperative for Chooralmala, Wayanad, to identify vulnerabilities and potential impacts within the sector. This assessment will be integrated into the State and District Disaster Management Plans, guiding safer settlement planning, aligning future infrastructure with disaster risk reduction strategies, and enhancing the resilience of the animal husbandry sector against region-specific hazards such as landslides and floods.
2	Diverse livestock population	The diverse livestock population in Chooralmala, Wayanad, enhances disaster resilience by exhibiting varying degrees of resistance to diseases, climate changes, and environmental challenges across different species and breeds. This diversity functions as a natural insurance mechanism for farmers, ensuring that if one segment is adversely affected by a particular threat, others may remain resilient, thereby safeguarding livelihoods and fortifying the overall resilience of the animal husbandry sector.

* *Continued in the next page*

Sl. No.	Initiative	Description
3	Adaptive Breeding Programs	Encouraging farmers in Chooralmala, Wayanad, to diversify their livestock holdings fosters agricultural resilience and promotes sustainable farming practices by preserving breeds adapted to local conditions. This approach enhances the sector's capacity to withstand challenges and safeguards community livelihoods against disaster impacts by conserving the genetic diversity within the livestock population.
4	Emergency Response Plans	Establishing a Veterinary Relief and Rescue Team in Chooralmala, Wayanad will significantly enhance the department's capacity to respond promptly to disasters, providing immediate veterinary care to animals in distress and safeguarding livestock health. Well-defined emergency response plans, encompassing evacuation procedures, shelter management, effective communication strategies, and clearly delineated roles, will ensure a swift and efficient response, minimising risks to both livestock and farmers.
5	Insurance and Risk Management	Implementing comprehensive insurance programs for farmers in Chooralmala, Wayanad, bolsters financial resilience, provides a safety net for dairy animals, and facilitates economic recovery after natural disasters. While current insurance schemes primarily focus on dairy animals, developing tailored solutions and risk management strategies for other livestock, such as pigs and goats, is imperative to ensure comprehensive financial support for all farmers.
6	Fodder Management for Emergencies	Effective disaster management mandates meticulous planning for the nutritional requirements of each animal, particularly within relief camps. This approach is indispensable for safeguarding the health, facilitating recovery, and maintaining the productivity of livestock post-disaster.
7	Animal Health Camps	The strategic planning of animal health camps is paramount for effective post-disaster management in Chooralmala, Wayanad, where animals are particularly vulnerable and necessitate immediate veterinary care. These camps are indispensable for addressing the health needs of livestock, ensuring their recovery and mitigating the risk of disease outbreaks post-disaster.
8	Management of Carcass	The strategic planning of carcass management is paramount in Chooralmala, Wayanad, for the systematic disposal of dead animals' post-disaster, mitigating health risks to both animals and humans. Proper disposal is indispensable for preventing disease transmission and the contamination of water sources, safeguarding the health and environment of the affected community.
9	Alternate Livelihood Options	Exploring alternative livelihood options in Chooralmala, Wayanad, is a pragmatic approach, particularly considering the challenges faced by individuals who have lost land and livestock due to the disaster. This initiative not only provides new avenues for affected families to sustain their livelihoods but also supports the relocation of those needing to move away from vulnerable locations, thereby enhancing their long-term resilience.

13



Tourism

13.1. Basic Profile of the Sector

Wayanad[4], located in the northern part of Kerala, is a picturesque district known for its natural beauty, rich culture and historical significance. It is a popular tourist destination, especially for nature enthusiasts and adventure seekers. This area is famous for its large amount of camping and trekking trails, breath-taking waterfalls, caves, bird-watching sites, flora, fauna and an overall plethora of magnificent sights.The following factors make Wayanad a popular tourist destination also generating revenue for the local population and the government.

Popular destinations

Kanthanpara waterfalls is a hotspot in Wayanad for tourists and travel vloggers worldwide. Other popular touring spots are Karapuzha Dam, Pookode and Karlad Lake. Cheengari Rock Adventure Center is a must-visit place for all adventure seeking tourists. Edakkal Caves are two natural rock formations believed to have been formed by a large split in a huge rock and the rock carvings are beautiful. Apart from all these hot spots Wayanad stands in the tri-junction of various other tourist places in Kerala, Karnataka and Tamil Nadu such as Ootty, Calicut, Nilambur, Mysore, Coonoor, Mudumalai. Wayand tourism consists of a large number of homestays and farm stays which offers opportunity stay and explore the agro-cultural aspects. Month-wise data of the domestic tourist visits as well as the foreign tourist visits to Wayanad in the last year have been depicted below.

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[4] *https://youtu.be/l4TelPR_Mzg?feature=shared*

WAYANAD

Location: Wayanad District in Kerala is in the Western Ghats, sharing borders with Karnataka and Tamil Nadu. Area under Forest cover: Around 806 sq. kms (37% of the total area).



PROTECTED AREA



Wayanad Wildlife Sanctuary covers a significant portion of these forests and forms part of the Nilgiri Biosphere Reserve.

TRIBAL POPULATION

Wayanad has the largest population of indigenous people with more than seven tribal communities

AVAILABILITY OF NATURAL PRODUCTS



Tourist are especially delighted by the range of exotic & indigenous products including spices, coffee, tea, bamboo products, honey herbs & rice availbale here.

CLIMATE



Wayanad has a tropical climate with moderate temperatures ranging between 20 degree celsius to 35 degree Celsius. It experiences significant rainfall during the monsoon season from June to September.

RICH BIODIVERSITY



Endemic Biodiversity: Wayanad boasts a rich biodiversity, including unique species like the Wayanad Laughing Thrush, Wayanad Dravido Gecko, Nilgiri Langur, Nilgiri Spiny Lizard, Glyptopetalum grandiflorum & Humboldtia brunonis. The Wayanad wildlife Sancturary is home to 45 mammel species, six of which are endemic to the Western Ghats. The avian populations, comprising 203 species, also includes 10 endemic bird species.

Table 13-1: *Domestic Tourist Visits to Wayanad in 2023*

January	146,919
February	112,353
March	105,554
April	168,432
May	200,719
June	137,687
July	136,079
August	157,440
September	121,983
October	142,864
November	129,197
December	191,040

Table 13-2: *Foreign Tourist Visits to Wayanad in 2023*

January	527
February	497
March	338
April	200
May	174
June	143
July	378
August	360
September	265
October	471
November	450
December	626

Table 13-3: *Domestic & Foreign Tourist Visits to Wayanad in 2023 - Comparison*

Year	Domestic Tourist Visits	Foreign Tourist Visits
2019	1,143,710	12,302
2022	1,509,207	1,967
2023	1,750,267	4,429

13.2. Economic Losses in the Sector

The landslide has not only halted current tourism activities but has also raised serious concerns about the long-term sustainability of tourism-driven development in such a fragile ecosystem.The destruction of infrastructure and negative publicity surrounding the disaster are likely to significantly impact tourist arrivals, leading to substantial economic losses for local businesses reliant on tourism.

Tourism in the affected region primarily revolves around homestays, resorts, and activities like sightseeing and trekking. Local vehicle owners, shopkeepers, and others dependent on tourism have been severely affected. The extreme rainfall events led to a complete shutdown of tourism activities across the district.

The landslide-hit area, encompassing three wards of the Meppadi Grama Panchayat, housed 75 hotels or resorts and 21 homestays, generating an annual revenue of approximately 40 Crs. To estimate the potential loss to the tourism sector, a projection has been made for the next three years.

This disaster underscores the need for a balanced approach to development in Wayanad. Economic growth through tourism should be carefully considered alongside the ecological and social risks associated with overdevelopment in vulnerable areas.

Tourism activities in Wayanad were significantly impacted by the heavy rains and subsequent restrictions on movement. This led to a sharp decline in the tourism industry and related economic activities. The recovery of this sector will require substantial effort.

To estimate the potential loss, a calculation was made based on unit costs and daily revenue, considering a 65% reduction in revenue generation.The time period for this estimation extends to December 2024, covering a total of six months from the date of the incident.

13.3. Response by the Department of Tourism

The Kerala Tourism Department responded promptly to the Mundakkai-Chooralmala landslide. They have collaborated with the District Disaster Management Authority to coordinate rescue operations. The Department identified a safe resort in the affected area to shelter stranded tourists and locals. To assess the impact on tourism, the Department liaised with various tourism associations, organizations, and local governments in Wayanad. They also contacted the District Police Chief to verify the safety of foreign tourists registered under the C-Form. along with them, the domestic tourists have also been considered with utmost care.

The Department extended hospitality to rescue teams and senior officials involved in the relief efforts. To revitalize Wayanad tourism, in collaboration with key stakeholders and tourism associations of Wayanad, the Department of Tourism has launched a comprehensive tourism campaign, including B2B partnership meets in South Indian states with significant tourism potential for Wayanad.

Figure 13-1: *Preserve Stone Resort before landslide*





Figure 13-2: *Preserve Stone Resort after landslide*

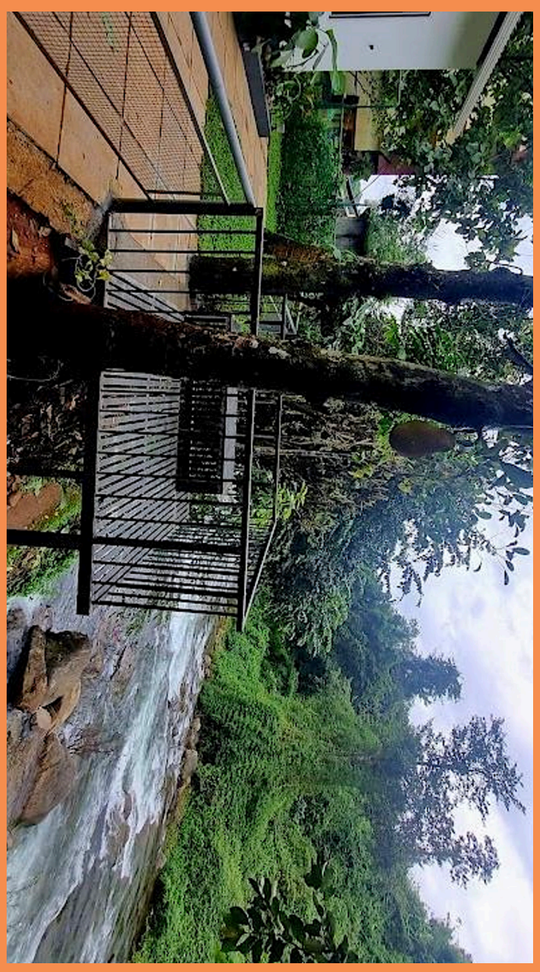


Figure 13-3: *Linora Service Villa before landslide*



Figure 13-4: *Linora Service Villa after landslide*

Table 13-4: *Tentative Revenue Loss in Hotel Sector (in the Landslide-Hit Region)*

Name of Affected Ward	Total No. of Hotels	Total No. of Rooms	Average Tariff (INR)	Tentative Loss (INR)					
				From July 30 to 31, 2024	From August to December 2024	2025	2026	2027	Total Tentative Loss
Attamala (Ward No. 10)	17	85	4000	6,80,000 (85 x INR 4000 x 2 days)	4,08,00,000 (85 x INR 4000 x 120 days	8,84,00,000 (85 x INR 4000 x 260 days)	8,84,00,000 (85 x INR 4000 x 260 days)	8,84,00,000 (85 x INR 4000 x 260 days	30,66,80,000
Mundakkai (Ward No. 11)	20	100	4000	8,00,000 (100 x INR 4000 x 2 days)	4,80,00,000 (100 x INR 4000 x 120 days)	10,40,00,000 (100 x INR 4000 x 260 days)	10,40,00,000 (100 x INR 4000 x 260 days)	10,40,00,000 (100 x INR 4000 x 260 days)	36,08,00,000
Chooralmala (Ward No. 12)	38	190	4000	15,20,000 (190 x INR 4000 x 2 days)	9,12,00,000 (190 x INR. 4000 x 120 days)	19,76,00,000 (190 x INR 4000 x 260 days)	19,76,00,000 (190 x INR 4000 x 260 days	19,76,00,000 (190 x INR 4000 x 260 days	68,55,20,000
TOTAL	**75**	**375**		**30,00,000**	**18,00,00,000**	**39,00,00,000**	**39,00,00,000**	**39,00,00,000**	**135,30,00,000**
(Rupees One Hundred Thirty-Five Crore and Thirty Lakh only)									

Table 13-5: *Tentative Revenue Loss in Homestay Sector (in the Landslide-Hit Region)*

Name of Affected Ward	Total No. of Home stays	Total No. of Rooms	Average Tariff (INR)	Tentative Loss (INR)					
				From July 30 to 31, 2024	From August to December 2024	2025	2026	2027	Total Tentative Loss
Attamala (Ward No. 10)	6	30	4000	2,40,000 (30 x INR 4000 x 2 days)	1,44,00,000 (30 x INR 4000 x 120 days)	3,12,00,000 (30 x INR 4000 x 260 days)	3,12,00,000 (30 x INR 4000 x 260 days)	3,12,00,000 (30 x INR 4000 x 260 days)	10,82,40,000
Mundakkai (Ward No. 11)	6	30	4000	2,40,000 (30 x INR 4000 x 2 days	1,44,00,000 (30 x INR 4000 x 120 days)	3,12,00,000 (30 x INR 4000 x 260 days)	3,12,00,000 (30 x INR 4000 x 260 days)	3,12,00,000 (30 x INR 4000 x 260 days)	10,82,40,000
Chooralmala (Ward No. 12)	9	45	4000	3,60,000 (45 x INR 4000 x 2 days)	2,16,00,000 (45 x INR 4000 x 120 days)	4,68,00,000 (45 x INR 4000 x 260 days)	4,68,00,000 (45 x INR 4000 x 260 days)	4,68,00,000 (45 x INR 4000 x 260 days)	16,23,60,000
TOTAL	**21**	**105**		**8,40,000**	**5,04,00,000**	**10,92,00,000**	**10,92,00,000**	**10,92,00,000**	**37,88,40,000**
(Thirty-Seven Crore, Eighty Eight Lakh and Forty Thousand only)									

Table 13-6: *Tentative Revenue Loss of all Accommodation Units in Wayanad District other than the Landslide-Hit Region*

Sl. No.	Name of Grama Local Body	Total No. of Units	Total No. of Rooms	Average Tariff (INR)	Tentative Loss (INR)			
					From July 30 to 31, 2024	August 2024	*September to December 2024 (Tentative Loss : 65%)	Total Tentative Loss
1	Ambalavayal	40	255	4000	20,40,000 (255 x INR 4000 x 2 days	3,16,20,000	80886000	114546000
2	Edavaka	8	28	4000	2,24,000 (28 x INR 4000 x 2 days	34,72,000	8881600	12577600
3	Kalpetta	48	321	4000	25,68,000 (321 x INR 4000 x 2 days)	3,98,04,000	101821200	144193200
4	Kaniyambetta	18	71	4000	5,68,000 (71 x INR 4000 x 2 days)	88,04,000	22521200	31893200
5	Kottathara	2	8	4000	64,000 (8 x INR 4000 x 2 days)	9,92,000	2537600	3593600
6	Mananthavady	44	179	4000	14,32,000 (179 x INR 4000 x 2 days)	2,21,96,000	56778800	80406800

Sl. No.	Name of Grama Local Body	Total No. of Units	Total No. of Rooms	Average Tariff (Rs.)	Tentative Loss (INR)			
					From July 30 to 31, 2024	August 2024	*September to December 2024 (Tentative Loss : 65%)	Total Tentative Loss
7	Meenangady	22	118	4000	9,44,000 (118 x INR 4000 x 2 days)	1,46,32,000	37429600	53005600
8	Meppady	54	216	4000	17,28,000 (216 x INR 4000 x 2 days)	2,67,84,000	68515200	97027200
9	Mullankolli	2	6	4000	48,000 (6 x INR 4000 x 2 days)	7,44,000	1903200	2695200
10	Mooppainad	55	235	4000	18,80,000 (235 x INR 4000 x 2 days)	2,91,40,000	74542000	105562000
11	Muttil	25	160	4000	12,80,000 (160 x INR 4000 x 2 days)	1,98,40,000	50752000	71872000
12	Nenmeni	30	147	4000	11,76,000 (147 x INR 4000 x 2 days)	1,82,28,000	46628400	66032400

Sl. No.	Name of Grama Local Body	Total No. of Units	Total No. of Rooms	Average Tariff (Rs.)	Tentative Loss (INR)			
					From July 30 to 31, 2024	August 2024	*September to December 2024 (Tentative Loss : 65%)	Total Tentative Loss
13	Noolppuzha	37	205	4000	16,40,000 (205 x INR 4000 x 2 days)	2,54,20,000	65026000	92086000
14	Padinjarathara	35	231	4000	18,48,000 (231 x INR 4000 x 2 days)	2,86,44,000	73273200	103765200
15	Panamaram	22	101	4000	8,08,000 (101 INR 4000 x 2 days)	1,25,24,000	32037200	45369200
16	Poothadi	30	118	4000	9,44,000 (118 x INR 4000 x 2 days)	1,46,32,000	37429600	53005600
17	Pozhuthana	16	108	4000	8,64,000 (108 x INR 4000 x 2 days)	1,33,92,000	34257600	48513600
18	Pulpally	12	62	4000	4,96,000 (62 x INR 4000 x 2 days)	76,88,000	19666400	27850400
19	Sulthan Bathery	40	478	4000	38,24,000 (478 x INR 4000 x 2 days)	5,92,72,000	151621600	214717600

Sl. No.	Name of Grama Local Body	Total No. of Units	Total No. of Rooms	Average Tariff (Rs.)	Tentative Loss (INR)			
					From July 30 to 31, 2024	August 2024	*September to December 2024 (Tentative Loss : 65%)	Total Tentative Loss
20	Thariyode	21	122	4000	9,76,000 (122 x INR 4000 x 2 days)	1,51,28,000	38698400	54802400
21	Thavinjal	22	101	4000	8,08,000 (101 x INR 4000 x 2 days)	1,25,24,000	32037200	45369200
22	Thirunelli	26	124	4000	9,92,000 (124 x INR 4000 x 2 days	1,53,76,000	3,93,32,800	5,57,00,800
23	Thondarnad	13	70	4000	5,60,000 (70 x INR 4000 x 2 days)	86,80,000	2,22,04,000	3,14,44,000
24	Vellamunda	17	112	4000	8,96,000 (112 x INR 4000 x 2 days)	1,38,88,000	3,55,26,400	5,03,10,400
25	Vengappally	6	59	4000	4,72,000 (59 x INR 4000 x 2 days)	73,16,000	1,87,14,800	2,65,02,800
26	Vythiri	168	1254	4000	1,00,32,000 (1254 x INR 4000 x 2 days)	15,54,96,000	39,77,68,800	56,32,96,800
TOTAL		**813**	**4,889**		**3,91,12,000**	**60,62,36,000**	**155,07,90,800**	**219,61,38,800**
(Rupees Two Hundred Nineteen Crore, Sixty-One Lakh, Thirty-Eight Thousand and Eight Hundred only)								

Table 13-7: *Tentative Loss in Tour & Travel Operations*

Tour & Travel Operations	Total No. of Operators	Average Income per Day (INR)	Tentative Loss (INR)		
			From July 30 to 31, 2024	From August 2024	Total Tentative Loss
Tour Travel & Operators	20	5,00,000 (20 x Rs. 25,000)	10,00,000 (INR 5,00,000 x 2 days)	1,55,00,000 (INR 5,00,000 x 31 days)	1,65,00,000
Local Jeep/Taxi Operators	265	5,30,000 (265 x Rs. 2000)	10,60,000 (INR 5,30,000 x 2 days)	1,64,30,000 (INR 5,30,000 x 31 days)	1,74,90,000
TOTAL					**3,39,90,000**
(Rupees Three Core, Thirty-Nine Lakh and Ninety Thousand only)					

Table 13-8: *Tentative Loss in Responsible Tourism and Salary Income of Guides and Employees in Tourism Sector*

Particulars	No. of Units	Average Income per Day (INR)	Tentative Loss (INR)		
			From July 30 to 31, 2024	From August 2024	Total Tentative Loss
Village Life Experience (VLE) Tour Packages	3	8,400 (3 x 2,800)	16,800 (2 x 8,400)	2,60,400 (2 x 8,400)	2,77,200
Income from the Sale of Responsible Tourism Products	45	22,500 (45 x INR 500) (Avg. profit / day)	45,000 (INR 22,500 x 2 days)	6,97,500 (INR 22,500 x 31 days)	7,42,500
Employees working in Tourism Sector	141	35,250 (141 x INR 250	70,500 (INR 35,250 x 2 days)	1092750 (INR 35,250 x 31 days)	11,63,250
TOTAL			**2,77,200**	**2,77,200**	**2,77,200**
(Rupees Twenty One Lakh, Eighty Two Thousand, Nine Hundred and Fifty only)					

Table 13-9: *Tentative Loss in Tourist Destinations*

Destinations	Total No. of Destinations	Average Income per Day (INR)	Tentative Loss (INR)		
				From August 2024	Total Tentative Loss
Owned By District Tourism Promotion Council (DTPC)	12	3,75,000	7,50,000	1,16,25,000 (August only)	1,23,75,000
Owned By KSEB Hydel Tourism	1	6,17,000	12,34,000	1,91,27,000 (August only)	2,03,61,000
Owned by ST Development Society	1	80,000	1,60,000	*24,80,000 (August only)	26,40,000
Adventure Tourism (Under Private Sector)	25	7,50,000 (25 x INR 30,000)	19,00,000	14,53,50,000	14,72,50,000
Tent Camping	37	11,000 (37 x 5 tents x INR 2200)	8,14,000 (37 x INR 11,000 x2 days)	16,83,000	24,97,000
TOTAL	**76**		**48,58,000**	**18,02,65,000**	**18,51,23,000**
(Rupees Eighteen Crore, Fifty-One Lakh and Twenty Three Thousand only)					

Table 13-10: *Component Share of Revenue Loss to Tourism Sector*

Tourism Product	Tentative Revenue Loss (INR in Crore)	Percentage Share of Loss (%)
Accommodation Units	392.80	94.67
Adventure Tourism	14.97	03.61
Destinations	3.54	0.85
Tour & Travels	3.40	0.82
RT & Guides	0.22	0.05
TOTAL	**414.93**	**100**

Socio-Economic Impact on Tourism Sector

The recent Mundakkai landslide has had a significant socio-economic impact on the region's tourism sector, which is one of the district's main economic drivers. The landslide has caused the following impacts on tourism:

- **Decline in Tourist Arrivals**

  Wayanad is a popular destination known for its scenic landscapes, wildlife sanctuaries and cultural heritage. However, the landslide has led to decline in tourist arrivals as safety concerns have grown and travel routes have been disrupted. The perception of Wayanad as a risky destination may persist, leading to a long-term decrease in visitor numbers.

- **Damage to Infrastructure**

  Key tourist infrastructure including roads, bridges and accommodation facilities has been damaged or destroyed by the landslide. This not only affects the accessibility of tourist sites but also reduces the region's capacity to host visitors. The repair and reconstruction of this infrastructure will take time and resources, delaying the recovery of the tourism sector. In addition to this, many of the local communities have also been forced to be rehabilitated.

- **Loss of Revenue**

  The decline in tourism has resulted in significant revenue losses for local businesses, including hotels, restaurants, homestays, adventure tour operators, tent camping, travel agencies and shops that depend on tourist spending. Many MSMEs in Wayanad rely heavily on tourism for their income, has also severely impacted especially their livelihoods.

- **Job Losses and Economic Hardship**

  The tourism industry in Wayanad employs a large number of people including guides, drivers, hospitality workers and artisans. The downturn in tourism has led to job losses and reduced income for these workers, exacerbating economic hardship in the region. This is particularly concerning in an area where many depend on seasonal tourism for their livelihood.

- **Impact on Tourism Related Investments**

  The uncertainty caused by the landslide may deter future investments in the tourism sector. Potential investors might view Wayanad as a high-risk area, which could limit the growth and development of new tourist facilities and services.

- **Environmental Concerns**

  The landslide has highlighted the environmental vulnerabilities of the region, which could lead to increased scrutiny and regulation of tourism activities. While this is necessary for sustainable development, it could also result in restrictions on certain types of tourism, further impacting the sector's growth.

In brief, the recent landslide in Mundakkai has caused a significant setback to the tourism industry, with immediate and long-term socio-economic consequences. Recovery will require coordinated efforts to rebuild infrastructure, restore confidence among tourists, and support the local communities dependent on tourism for their livelihoods.

13.4. Reconstruction and Recovery Needs

The reconstruction and recovery of Wayanad's tourism sector following the recent landslide require a comprehensive and multi-faceted approach.

The needs include:

1. Infrastructure Rehabilitation:

Roads and Bridges: Repair and rebuild damaged roads and bridges to restore access to key tourist destinations. This will require immediate attention to ensure that travel routes are safe and functional.

Accommodation and Facilities: Reconstruct damaged hotels, resorts, homestays, and other tourist facilities in an eco-friendly manner, subject to the approval of the expert committee's report. Need to support by providing financial assistance to MSMEs through loans or grants to aid in reconstruction efforts. By considering through offering interest subsidies and moratoriums on existing loans for MSMEs.

2. Environmental Restoration:

Land Stabilization: Implement land stabilization measures to prevent further erosion and landslides. This not only protects the environment but also ensures the long-term safety and appeal of the region for tourists.

Sustainable Tourism Practices: Encourage the adoption of eco-friendly and sustainable and responsible tourism practices to minimize environmental impact and promote resilience against future natural disasters.

3. Financial Assistance and Support:

Compensation and Relief Funds: Provide financial assistance to affected businesses and workers including compensation for lost income and relief funds for rebuilding.

Soft Loans and Grants: Offer low-interest loans or grants to tourism operators and MSMEs to help them recover and rebuild their businesses.

4. Job Opportunities:

Semi-Governmental Institutions: Job opportunities to the members of affected families may be provided in the semi-governmental institutions/ societies like En-Ooru, DTPC, Hydel Tourism etc.

Support from Hotels, Resorts, Homestays & Tent Camps: The tourism properties like hotels, resorts, homestays & tent camps may provide job opportunities to the trained members of the affected families for their services like laundry, catering, housekeeping etc.

5. Promotion and Marketing:

Rebranding and Reassurance Campaigns: Launch targeted marketing campaigns to restore Wayanad's image as a safe and attractive tourist destination. These campaigns should focus on the natural beauty, cultural heritage and efforts to rebuild sustainability.

Conducting B2B Partnership Meets: B2B Partnership Meets may be conducted in the Southern States of India where Wayanad tourism finds a better market.

Incentives for Tourists: Introduce incentives such as discounts, special packages or guided tours to encourage tourists to return to Wayanad.

6. Community Involvement and Capacity Building:

Training and Capacity Building: Provide training programs for local communities in sustainable tourism, disaster preparedness and hospitality management. State government institutions

like Kerala Institute of Tourism and Travel Studies (KITTS), Food Craft Institute (FCI), State Institute of Hospitality Management (SIHM) and the central government institutions like Hunarse Rozgar Tak (HSRT) and NABARD are ready to impart training to the affected people as part of the capacity building program. This will help to build resilience and ensure that tourism can continue to thrive in long term.

Community-Based Tourism Initiatives: Promote community-based tourism initiatives that empower local communities and ensure that the benefits of tourism are widely shared.

7. Disaster preparedness and Risk Management:

Early Warning System: Improve early warning systems and disaster preparedness plan specifically for the tourism sector. This includes educating tourism operators and tourists about safety protocols in the event of future landslides or other natural disasters.

Insurance Schemes: Encourage tourism businesses to adopt insurance schemes that cover losses due to natural disasters, reducing the financial burden in the aftermath of such events
.

8. Collaboration and Governance:

Public-Private Partnerships: The public-private partnership model is a key strategy for Kerala Tourism. To further enhance this approach and ensure a coordinated recovery process, collaboration with local communities is essential. Local communities can form clusters to initiate farm tourism initiatives by pooling their land resources. These farms can be promoted by the Responsible Tourism Society under the Kerala Tourism Department through farm tours and village life experiences.

Policy Support: Implement supportive policies that facilitate the quick reconstruction of tourism infrastructure and provide tax relief or incentives for businesses affected by the landslide.

9. Introducing New Tourism Products:

Heli-Tourism: Helicopter Tourism is a growing segment in Kerala that offers tourists a unique way to explore the scenic beauty of the state from the sky. The landslide-hit region may an ideal destination for the helicopter tourism. Electric helicopter would be preferable in this region.

Caravan Parks: Caravan Parks are the specialized sites where tourists can park their caravans, enjoy the natural surroundings and experience the local culture in a serene environment. Local communities may be supported to start caravan parks in the appropriate places where the tourists can enjoy the scenic beauty of that region.

Reconstruction – Recovery Cost Estimates

The cost estimate detailed in***Table 13-11*** is exclusively for the purpose of finding livelihood for the landslide affected families. The cost estimate of the construction of buildings for their rehabilitation has been excluded from this list, since the same has already accounted in the housing section.

An additional facility for homestay is planned as part of the newly constructed 250 households. For this purpose, an amount of INR 1,80,000 is budgeted for setting up homestays as part of the houses in the new township. The budgeted amount covers the construction of a room with attached bathroom, furniture, fixtures and appliances

Thus, an amount of INR 25.68 Crs. is budgeted for the recovery and reconstruction activities against the anticipated revenue loss and damages. Most of the tourism facilities in Wayanad operating now are private facilities which are privately owned. The revenue generation of these facilities can be accelerated through the campaigns and other centres and amenities proposed in the reconstruction and recovery plan. Budgeting for home stay facility creation in the new township will help the affected population in additional income generation through tourism activities. Thus, the tourism industry which occupies a grand share in the economy of Wayanad District can be rejuvenated post Meppadi landslide.

Table 13-11: *Reconstruction Measures – Hard Infrastructure for Developing Tourism in the New Township*

Sl. No.	Reconstruction Measures	Number/Units	Cost Estimate (in Crores)	Time-line	Lead Department
1	Construction of building	3	7.00	1 year	Tourism
2	Handloom unit	2 units with 10 looms each	0.30	1 year	Khadi & Village Industries
3	Honey Museum with Park	1	1	1 year	
4	Bamboo Handicraft	4	0.20	1 year	
5	Setting up homestays in the township in 250 houses (Approximate cost including construction, fixtures and furnishing of rooms @ Rs 0.055 Cr per HH)				
6	Construction of additional room and toilet for 2-person occupancy 150 sq. ft. (14 sq. m.)	250 @ INR 1500 sq. ft.	5.625	Long term	Tourism
7	Fixtures and Appliances	250 @ INR 1,55,000 unit	3.875	Long term	Tourism
8	Furnishing	250 @ INR 1,20,000 unit	3	Long term	Tourism
9	Insurance – 10 years @ INR 5000	250	1.25	Long term	Tourism
Total (INR 22.25 Crores)			**22.25**		

As part of the recovery plan, a mass media campaign through various media options are planned since the tourism industry is in a recession across Wayanad district. The campaign will help in boosting the tourism activities and increasing the footfall across private owned facilities across Wayanad.

E-bike stands for the tourism stakeholders were planned to be provided at 10 locations across Wayanad. This will facilitate the easy small distance conveyance of the customers and providers across Wayanad. This will also help reviving the tourism linked local economy without altering the Carbon footprint.

Table 13-12: *Recovery Measures – Tourism Promotion Activities*

Sl. No.	Recovery Measures	Number/Units	Cost Estimate (in Crores)	Timeline	Lead Department
1	Hoarding printing & logistics	100 Boards	040	2 months	
2	Radio	3 days – All Kerala	0.10	1 month	
3	Theatre	3 days – All Kerala	0.70	1 month	
4	Music Video	1	0.25	2 months	
5	Influencers and content creators		0.13	2 months	
6	District specific pages		0.07	1 month	
7	Production of social media videos of celebrities and campaign creative design charges		0.18	3 months	
8	Tribal festival with ambience created including art, culture and sports events	5 days	0.90	3 months	
9	Procurement of E-bikes for setting up bike-sharing stands at 10 locations	100 @ INR 70,000/-	0.7	Medium	Tourism
Total (INR 3.43 Crores)			**3.43**		
Grand total for reconstruction and Recovery			**25.68**		



14



MSME, Small/Local Businesses, Livelihoods

14.1. Basic Profile of the Sector

Micro, Small, and Medium Enterprises (MSMEs) play a vital role in India's economy, contributing over 29% to its GDP. The Department of Industries and Commerce in Kerala is dedicated to promoting the growth and development of MSMEs in the state.

The Department has been actively involved in identifying and nurturing entrepreneurs, providing essential support services, and facilitating access to financial assistance. These efforts have included skill development programs, infrastructure support, assistance with licenses and clearances, and marketing guidance.

Kerala's MSME sector is particularly strong in agro-based businesses, including food processing, readymade garments, light engineering, biotechnology, rubber-based industries, information technology, tourism, and trade. These sectors form the backbone of the state's economy. The Government of Kerala's 'Year of Enterprises' project was recognized as a best practice initiative at the national level, demonstrating the state's commitment to MSME development. During this period, the state successfully established over one lakh new enterprises.

Wayanad's economy is primarily driven by tourism, traditional handicrafts, agro-based food processing, readymade garments, and other manufacturing and service industries. The Mundakkai-Chooralmala area, in particular, heavily relied on micro-enterprises for local livelihoods.

Key sectors included food processing, rural engineering, furniture manufacturing, salons, grocery stores, and related businesses.

These enterprises catered to both local residents and tourists, leveraging the region's popularity as a tourist destination. Many of these businesses were locally owned, providing employment opportunities to the local population. Additionally, the region's renowned tea, coffee, pepper, and cardamom plantations contributed significantly to local employment.

14.2. Sectoral Policies

Government assistance for MSMEs primarily focuses on loan-based schemes offered by scheduled banks. Entrepreneurs are required to contribute a portion of the project cost, with the government providing financial assistance in the form of subsidies or interest subventions. The following are a few Central Schemes for promoting MSMEs:

1. **Prime Minister Employment Generation Program (PMEGP):**

   Maximum subsidy of INR 50 lakhs for manufacturing and INR 25 lakhs for service sectors.

   - 95% financial assistance from banks, 5% own contribution.
   - 35% subsidy in rural areas, 25% in urban areas.

2. **PM Formalization of Micro Food Processing Enterprises Scheme:**

   - Enhances competitiveness of micro food processing enterprises.
   - Subsidy of 35% up to INR 10 lakhs.
   - Supports farmer producer organizations (FPOs) and Self-Help Groups.

The state government of Kerala has initiated several schemes for supporting MSMEs. The following overview provides a detailed understanding of the government's initiatives and support programs for MSMEs in Kerala.

By leveraging these resources, MSMEs can enhance their competitiveness, access financial assistance, and contribute to the state's economic growth.

1. Entrepreneur Support Scheme (ESS):

- Prioritizes manufacturing sector.
- Maximum subsidy of 45% up to INR 40 lakhs.

2. Margin Money Grant to Nano Units:

- Provides finance to nano units in manufacturing, job work, and service activities.
- Up to 40% margin money grant for units with project cost up to INR 10 lakhs.

3. One Family One Enterprise (OFOE):

- Encourages entrepreneurship in every household.
- Interest subvention of up to 6% for MSME loans up to INR 10 lakhs.

4. Assistance Scheme for Handicrafts Artisans (ASHA):

- Provides grants to artisans for setting up handicraft activities.
- 40% assistance for general category (INR 5 lakhs), 50% for special category (INR 7.5 lakhs).

5. MSME Scale-up Mission (MISSION 1000):

- Aims to uplift 1000 MSMEs to businesses with INR 100 Crore turnover within 4 years.
- Capital investment subsidy up to 40% (maximum INR 2 Crore).
- Interest subvention for working capital loans up to 50% of the interest rate (limited to INR 50 lakhs).

14.3. Damage Assessment

Unanticipated events like natural disasters can place a heavy financial strain on micro, small, and medium-sized enterprises (MSMEs). The extent of this impact varies depending on the nature of the hazard, the level of risk exposure, contextual vulnerabilities, and the specific attributes of the affected businesses. One of the primary financial challenges businesses faces after a disaster is infrastructure damage. This can force businesses to close temporarily, as the repairs needed to restore operations are resource intensive. Without insurance or sufficient funds to cover these repairs, the chances of business survival are significantly reduced.

Table 14-1: *Impact of Meppadi Landslide on MSMEs*

Sector	Machinery/Stock Loss	Building Damage
Manufacturing	Significant	Substantial
Service-Oriented	Significant	Moderate
Trading	Significant	Minor
Total	Extensive	Varying

Even for those who manage to reopen, severe physical damage can negatively affect their performance, prolonging the closure period and requiring more resources for undertaking repairs, especially for those without insurance. Additionally, interruptions in essential public services such as electricity, water, fuel supply, transportation, and telecommunications can further disrupt business operations and lead to closures or even population displacement.

The 2024 Meppadi landslide had a significant impact on micro, small, and medium-sized enterprises (MSMEs) in the region. A total of 84 MSME units were affected, including 12 manufacturing units, 25 service-oriented units, and 47 trading units. The majority of machinery and stock were either completely lost or rendered unusable.

The buildings housing these establishments sustained substantial damage, requiring extensive repairs for those that remained usable. The estimated total MSME loss, excluding building costs, amounted to INR 36.11 crores. An estimated 222 jobs were lost, and the plantation sector was particularly hard hit, with 409 permanent employment opportunities lost and an estimated wage loss of INR 17.38 crores

LOSS ESTIMATE

The manufacturing sector was particularly hard hit, with 12 micro-manufacturing units affected. This led to the loss of 48 jobs and an estimated economic loss of INR 6.26 crores. The service sector was also impacted, with 25 micro-service enterprises affected, resulting in the loss of 64 jobs and an estimated economic loss of INR 10 Crs. The trading sector suffered the most significant losses, with 47 micro-trading units affected, leading to the loss of 110 jobs and an estimated economic loss of INR 19.85 Crs. To assess the losses incurred, the damage to machinery and equipment, the value of raw materials and inventory, rental expenses, advances paid to property owners, and income loss due to the destruction of livelihood resources were considered.

Wages lost due to job loss were calculated by determining the total monthly wage loss and projecting it over a three-year period, reflecting the anticipated rehabilitation time frame. Building rent was assessed by considering the total square footage occupied by the enterprises and applying market value rates for commercial rentals, which were also projected over three years.Furthermore, the calculations included advances paid by entrepreneurs to banks for machinery and inventory purchases, which would require repayment.

Socio-Economic Impact of the Disaster

Disproportionate Impact on the Trading Sector:
The trading sector was disproportionately affected, with 47 micro-trading units impacted, accounting for 56% of the total MSMEs. This sector experienced the highest estimated economic losses (INR 19.85 crores) and job losses (110 jobs).

Significant Impact on Manufacturing and Service Sectors:
The manufacturing and service sectors were also significantly impacted, with 12 and 25 units affected, respectively. While the economic losses in these sectors were lower than in the trading sector, the job losses were substantial, with 48 and 64 jobs lost, respectively.

Economic Ripple Effects:
The closure of MSMEs due to the landslide had broader economic consequences for the local

Table 14-2: *Losses in the MSME Sector*

Sector	Number	Employment	Amount (Damage + Loss)	Amount (in Crores)
Manufacturing (Micro)				
Food Products	1	6	85,76,000	0.86
Grain mills products	1	3	78,75,500	0.79
Wood and wood products	4	15	2,29,31,500	2.29
Metal products and machinery	4	19	1,79,56,500	1.79
Handicraft	1	2	24,58,000	0.24
Curtain Manufacturing	1	3	27,76,000	0.28
Total	**12**	**48**	**62573500**	**6.25**
Service (Micro)				
Food and Beverages	5	23	2,55,10,000	2.55
Motor Vehicle repair and maintenance	1	2	19,61,000	0.196
Others	19	39	7,25,53,900	7.25
Total	**25**	**64**	**100024900**	**10**
Trade (Micro)				
Agriculture produces	5	11	2,37,66,700	2.38
Food and Beverages	9	20	2,65,36,000	2.65
Household Equipment	10	22	3,28,81,100	3.28
ICT equipment	1	3	66,23,500	0.66
Motor Vehicle repair and maintenance	1	2	22,12,000	0.22
Non-specialized shops	14	38	7,64,34,000	7.64
Recreation Reading Games	2	4	53,20,000	0.53
Others	5	10	2,48,08,900	2.48
Total	**47**	**110**	**198,582,200**	**19.85**
Grand Total	**84**	**222**	**361,180,600**	**36.11**

Sector	Damage Amount (Tangible Assets Excluding Building)	Loss Amount (Wages Loss) (3 Years)	Loss (building Advance and Rent)	Loan from Banks	Total Loss (in Crore)
Manufacturing (Micro)	1.3	3.85	0.60	0.5	6.26
Service (Micro)	3.1	4.55	1.05	1.3	10
Trade (Micro)	7.96	6.76	1.83	3.3	19.85
Total	**12.36**	**15.16**	**3.48**	**5.1**	**36.11**

Table 14-3: *Estimate of Nature of Damage and Loss*

Table 14-4: *Summary of Disaster Impact on MSME Sectors*

Sector	Manufacturing	Service	Trade
Subsectors	• Food and bakery product production • General engineering • Wooden furniture manufacturing • Traditionalhandi-craft production	• Bakery • Salons • Rental shops • Tailoring	• Food and bakery product production • General engineering • Wooden furniture manufacturing • Traditional handi-craft production
Impact	**Units Affected:** 12 units were completely lost **Tangible Asset Losses:** INR 1.30 crores **Wage Losses:** INR 3.85 crores **Building Rent and Advance Losses:** INR 0.60 crore **Loan Repayments:** INR 0.50 crore **Employment Loss:** 48 individuals	**Units Affected:** 25 units were completely lost **Tangible Asset Losses:** INR 3.1 crores **Wage Losses:** INR 4.55 crores **Building Rent and Advance Losses:** INR 1.05 crores **Loan Repayments:** INR 1.30 crores **Employment Loss:** 64 individuals	**Units Affected:** 47 units were lost entirely **Tangible Asset Losses:** INR 7.96 crores **Wage Losses:** INR 6.76 crores **Building Rent and Advance Losses:** INR 1.83 crores **Loan Repayments:** INR3.3 crores **Employment Loss:** 110 individuals

community. These businesses play a crucial role in supporting other local businesses and industries, creating a multiplier effect on the local economy.

Vulnerability of Micro-Scale MSMEs:
Micro-scale MSMEs are particularly vulnerable to disasters due to their limited resources and capacity to cope with shocks. They often lack the financial resilience and risk management strategies to withstand such events.

14.4. Reconstruction and Recovery Measures

For the Revival and Creation of Livelihood Opportunities in MSMEs

The rehabilitation of livelihoods in disaster affected areas requires significant effort and time, as it entails establishing livelihood resources from the ground up. Furthermore, training and educating individuals in all aspects of enterprise management is crucial. Capacity building programs and ongoing support are essential, especially for those venturing into new livelihood endeavours, as they may lack experience in their specific field. These initiatives aim to foster sustainable and competitive enterprises within the new environment.

The measures outline a comprehensive approach to livelihood rehabilitation for MSMEs in the disaster-affected areas of Wayanad, projected to create 600 direct employment opportunities. It emphasizes creating sustainable and competitive enterprises by providing grants, skill development, and ongoing support. Through a better livelihood ecosystem that fosters self-reliance and economic growth in the region.

Table 14-1: *Proposed interventions in each term*

LONG TERM

- Livelihood opportunities can be created by providing grants for establishing commercial, industrial, & nano household establishments.
- Activities such as rural transport units are also included.
- A craft village is also proposed, which can create great opportunities for artisans.
- A total of 600 direct employment opportunities are expected to be made.
- Skill training and capacity-building programs are also proposed for the beneficiaries to support them in establishing, marketing, operating & formalising their enterprises.

MEDIUM TERM

Supporting new & upcoming MSMEs in the transition phase

SHORT TERM

Employment in existing MSMEs

- Capitalize on existing skills & needs within MSMEs to create immediate employment opportunities.

Table 14-5: Proposed Interventions Summary

Grants:

- **Industrial Units (Max. Cost: INR 20 Lakhs per unit):** Establish 50 industrial units (50 sq. m. each) with expert committee approval, handholding support, and skill development training. Estimated cost: INR 9.52 Crore.
- **Commercial Units :** Accounted in the section under Public Buildings and Commercial Infrastructure
- **Nano Household Units (INR 3 Lakhs per unit):** Establish 200 nano household units (100 sq. ft. each) for rural livelihood activities with expert committee approval, handholding support, and skill development training. Estimated cost: INR 6 Crore.

- **Rural Transport Units (INR 6 Lakhs per unit):** Provide grants for purchasing passenger and goods vehicles, based on further assessments and expert committee approval. Handholding support and training will be included. Estimated cost: INR 3 Crore.

- **Capacity Building (Cost: INR 8 Crore):**

  - **Training:** Provide training on new technologies, sustainable business models, marketing, personal development, and enterprise management.
  - **Ongoing Support:** Engage IAGs, NGOs or professionals to offer long-term assistance in establishing and operating enterprises.

- **Craft Village (Cost: INR 7.14 Crore):**

  - **Purpose:** Promote crafts, offer training programs, and showcase artisan products.
  - **Facilities:** Showcase area, demonstration areas, training centre, conference hall, dormitories, and administration block.
  - **Target Group:** Benefit approximately 120 artisans in the affected Panchayat.
  - **Expected Outcome:** Boost tourism and economic growth.

- Pooled Fund: Allocate additional funds for increased applications or unforeseen expenses during unit setup or expansion.

  - **Purpose:** To provide supplemental funding to MSMEs for project setup, expansion, or working capital requirements.
  - **Eligibility:** MSMEs that have received initial grants and require additional financial assistance.
  - **Funding Criteria:** The allocation of funds will be based on the specific needs of the MSMEs and the availability of resources in the pooled fund.
  - **Monitoring and Evaluation:** Regular monitoring and evaluation will be conducted to ensure that the funds are used effectively and efficiently.

Proposal for Providing Grants for Establishing Industrial Units

The proposal proposes a grant program to support the establishment of new industrial units in the disaster affected region. Eligible MSMEs can apply for grants of up to INR 20 lakhs to initiate their industrial ventures. Proposals will undergo a rigorous review by an expert committee to ensure their feasibility and alignment with the region's economic development priorities. Successful applicants will receive comprehensive support, including handholding guidance, skill training, and capacity-building programs. The aim is to establish 50 industrial units, each with an estimated built-up area of approximately 50 sq. m. The total estimated cost for this initiative is INR 9.52 crore. This program aims to stimulate economic recovery, create job opportunities, and promote industrial growth in the region.

Providing Grants for Establishing Commercial Units

This proposal outlines a grant program designed to support the establishment of new commercial units in the disaster affected region. Eligible MSMEs can apply for grants of up to INR 10 lakhs to initiate their commercial ventures. Proposals will undergo a rigorous review by an expert committee to assess their feasibility and alignment with the region's economic development priorities. Successful applicants will receive comprehensive support, including handholding guidance, skill training, and capacity-building programs. The aim is to establish 110 commercial units. The total estimated cost for this initiative is INR 11 crore. This program seeks to stimulate economic recovery, create job opportunities, and promote commercial growth in the region. The physical infrastructure required to house these units is considered under the section on Public Buildings and Commercial Infrastructure.

Proposal for Providing Grants for Establishing Nano Household Units

This proposal outlines a comprehensive plan to support the establishment of nano household units in the disaster affected region. Nano household units, engaged in rural livelihood activities, will receive grants of up to INR 3 lakhs to initiate their ventures. To qualify, proposals must undergo review by an expert committee. Successful applicants will receive handholding support, skill training, and capacity-building training to ensure their success. A total of 200 nano household units are envisioned, each occupying approximately 100 square feet. The estimated total cost for this initiative is INR 6 crores. This program aims to stimulate economic recovery and provide livelihood opportunities for individuals and families in the region.
Rural Transport Units

This proposal outlines a grant program to support the purchase of passenger and goods transportation vehicles for MSMEs in the affected region. Eligible businesses can apply for grants of up to INR 6 lakhs to purchase new or refurbished vehicles. Proposals will be reviewed by an expert committee to assess their feasibility and alignment with the region's transportation needs. Successful applicants will receive comprehensive support, including handholding guidance, skill training, and capacity-building programs to ensure effective vehicle operation and management. The total number of vehicles to be purchased will be determined based on further assessments of transportation needs and available resources. The estimated total cost for this initiative is INR 3 crores. This program aims to facilitate transportation services, support economic recovery, and create new employment opportunities in the region.

Capacity Building

Given the significant impact of the disaster on the affected communities, capacity-building programs should be designed to motivate individuals to initiate new enterprises. Training should focus on introducing appropriate technologies for the rural population, such as renewable energy, agro-processing, and sustainable farming practices. The training curriculum should also include modules on marketing, personal development, and enterprise management to equip individuals with the necessary skills to succeed. To ensure long-term support, competent IAGs, NGOs or skilled professionals should be engaged on a long-term basis to provide ongoing guidance and assistance to applicants in establishing and operating their enterprises. The total estimated cost for these capacity-building initiatives is INR 8 crores. By providing comprehensive training and support, these programs aim to empower individuals to

create sustainable and competitive enterprises, contributing to the economic recovery of the region.

Craft village

The Craft Village will serve as a hub for promoting and showcasing the craftsmanship of local artisans. It will offer a variety of programs and workshops on craft appreciation, design, art, culture, and self-exploration. This initiative aims to promote artisans engaged in craft activities and provide them with a platform to showcase their work.

The facility will include a space for showcasing crafts, demonstration activities, a training center, a conference hall, dormitories, and an administrative block. Given Wayanad's reputation as a renowned tourist destination, the Craft Village is expected to further boost its tourism potential. Approximately 120 artisans residing in the landslide-affected Panchayat can benefit from this project.

The Craft Village will contribute to the overall economic growth of the area by providing opportunities for artisans to sell their products, learn new skills, and network with other artisans and potential buyers.

The estimated cost for setting up a Craft Village of an area of 2 ha in the Township is INR 6 Cr. An exhibition and sales centre of 300 sq. m. has been included in the Craft Village which is estimated to be INR 1.14 Cr.

By creating this vibrant centre for crafts and artisans, the Craft Village will not only support the economic recovery of the region but also preserve and promote the rich cultural heritage of Wayanad.

Pooled fund

To ensure adequate financial resources are available to support the establishment and growth of MSMEs in the affected region, a pooled fund will be established. This fund will serve as a reserve to provide additional funding to eligible units when the initial grant amounts are insufficient or when the number of applications exceeds the allocated resources.

By establishing a pooled fund, the initiative aims to provide a flexible and responsive mechanism to support the recovery and growth of MSMEs in the affected region. This will help to ensure that the program is sustainable and can adapt to changing needs and circumstances.

Table 14-6 *Recovery and reconstruction cost estimate*

Reconstruction Cost Estimate						
Sl. No.	**Reconstruction Measures**	**Numbers**	**Size (in sq.m.)**	**Unit Cost**	**Cost Estimate (in Crores)**	**Timeline**
1.	Construction of Industrial Units in the Township	50	50	38001	9.52	Long term
2.	Setting up a Craft Village of an area of 2 ha in the Township	1	1	3000	6	Long term
3.	Construction of exhibition and sales centre in the Craft Village	1	300	38001	1.14	Long term
Total Reconstruction Cost Estimate					**16.66**	
Recovery Cost Estimate						
1.	Procurement of machinery, equipment and tools for setting up commercial units	110	1	10,00,000	11	Long term
2.	Procurement of machinery, equipment and tools for setting up industrial units	50	1	20,00,000	10	Long term
3.	Supporting household units to procure tools, equipment, small machinery, and livestock	200	1	3,00,000	6	Medium-term
4.	Procurement of rural transport units – vehicles including auto rickshaws, taxis, goods vehicles	50	1	6,00,000	3	3-6 months
5.	Capacity Building activities including skill training, marketing support	1	1	8,00,00,000	8	Medium-term
6.	Pooled fund – for working capital and other initiatives	1	1	10,00,00,000	10	Medium-term
Total Recovery Cost Estimate					**48**	
Grand Total of Reconstruction and Recovery Cost Estimate (in Cr)					**64.66**	



CROSS-CUTTING

15



Disaster Risk Reduction

15.1. An Overview

Disaster Risk Reduction (DRR) comprises a comprehensive framework encompassing a diverse array of initiatives and strategies designed to mitigate the adverse effects of natural calamities. Key components of DRR include the meticulous identification and assessment of potential hazards, the implementation of preventive measures, the application of mitigation strategies, the establishment of preparedness plans, the execution of effective response operations, the facilitation of recovery processes, and the cultivation of resilient communities.

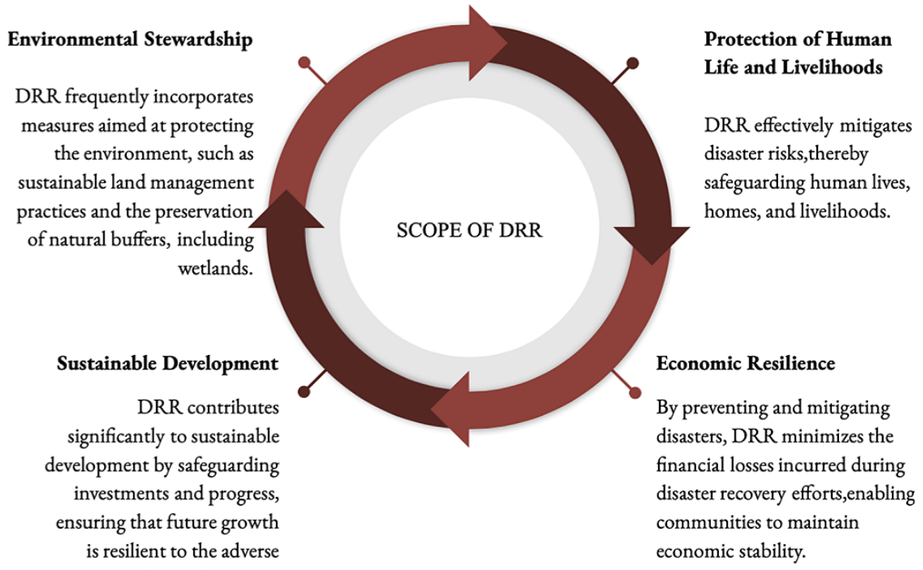
The overarching objective of DRR is to reduce vulnerabilities and minimize disaster risks across all societal strata.

By strategically addressing various aspects of disaster management, DRR endeavors to attenuate the impact of natural disasters on human life, livelihoods, property, and the environment.

Furthermore, DRR plays a crucial role in post-disaster recovery efforts, facilitating the restoration of affected areas to their pre-disaster state through the reconstruction of infrastructure, the reestablishment of essential services, and the provision of support for both economic and social recovery. Moreover, DRR involves the systematic analysis of past disasters to inform and enhance future prevention and response strategies.

The scope of DRR in the context of Kerala is illustrated in the following representation.

Figure 15-1: Scope of DRR



This section of the Post-Disaster Needs Assessment (PDNA) document is dedicated to a comprehensive analysis of Kerala's disaster management and response system. Particular emphasis is placed on the actions undertaken by various stakeholders during the disaster, with a focus on identifying and highlighting the challenges and shortcomings encountered. Furthermore, the report presents a thorough assessment of potential future risks within the land-slide-affected region, proposing feasible mitigation measures accompanied by approximate cost estimates. The gap analysis and recommendations outlined in this section are intended to serve as valuable guidance for policymakers, not only in facilitating the recovery efforts for the Chooralmala region but also in developing effective DRR strategies for landslide-prone areas within Wayanad district [***Figure 1-4***].

The report is the culmination of a rigorous research process that involved extensive consultation with stakeholders engaged in disaster management at various administrative levels and within the community. To enhance the depth and accuracy of the research, several field visits were undertaken. Additionally, personal interviews, focus group discussions, and intergroup exchanges with experts from other relevant sectors were conducted to gather diverse perspectives and insights.

15.2. Disaster Preparedness and Mitigation Systems in Kerala

Institutional Mechanism

Kerala State Disaster Management Authority (KSDMA):
The State Disaster Management Authorities are statutory bodies constituted under the Disaster Management Act, 2005 (Central Act 53 of 2005). Kerala State Disaster Management Authority is a statutory non-autonomous body under the Chairmanship of the Chief Minister of Kerala. KSDMA was constituted in 2007 under the Disaster Management Act of 2005 to institutionalize disaster management in Kerala, the authority is composed of ten members, chaired by Chief Minister and convened by Additional Chief Secretary, Revenue and Disaster Management.

KSDMA has formulated the Kerala State Disaster Management Policy, articulating the state's vision and strategy for disaster management. KSDMA has been at the forefront of response, rehabilitation, and mitigation efforts to all major disasters in Kerala.

District Disaster Management Authority:
The District Disaster Management Authority (DDMA) is the key coordinating body for disaster management at the district level. Chaired by the District Collector, the DDMA is responsible for preparing district disaster management plans, implementing risk reduction measures, and coordinating emergency response. The DDMA also oversees the functioning of Taluk and Village Disaster Management Committees.

Taluk EOC (Emergency Operation Center) and Village EOCs have been constituted to ensure community participation in disaster risk reduction. These committees, led by local elected representatives at the Grama Panchayat level, assist in hazard mapping, early warning dissemination, evacuation planning, and post-disaster relief and rehabilitation at the grassroots level empowering the community to be actively involved in disaster management.

Disaster Management Plans:
Local self-government institutions, including Panchayati Raj institutions and urban local bodies, are mandated to develop and implement disaster management plans that are adapted to their specific contexts. This initiative forms part of a broader strategy supported by the KSDMA and the Kerala Institute of Local Administration (KILA), which provide technical assistance and training to local officials. The local disaster management plans incorporate comprehensive hazard assessments, community awareness programs, and preparedness measures, ensuring that local governments are equipped to respond effectively to emergencies.

Village Disaster Management Committees have also been established to facilitate grassroots participation in disaster risk reduction activities, including training in first aid, evacuation procedures, and risk assessment. This collaborative approach positions local self-government as an integral component of the overall disaster management system.

Meppadi Grama Panchayat has undertaken several proactive measures to build capacity and reduce the vulnerability of the Panchayat to disasters. These initiatives are aimed at enhancing the community's resilience and preparedness in the event of natural calamities. The significant measures are detailed in the following illustration [***Figure 15-2***].

Kerala Fire and Rescue Services play a pivotal role in mitigating disaster risks at the local level by providing essential emergency response and preparedness support. With 129 fire and rescue stations strategically located across the state, the department is well-equipped to respond to a diverse range of emergencies, including fires, building collapses, and natural disasters such as landslides and floods.

Their responsibilities extend beyond firefighting to encompass community education on fire safety, life safety, and disaster management, thereby promoting awareness and preparedness among residents. The Fire and Rescue Services collaborate closely with local self-governments and other emergency response agencies to ensure the effective execution of evacuation, search, and rescue operations during disasters.

Moreover, the department has been actively involved in the Aapda Mitra program, which aims to train community volunteers in disaster response, further enhancing local preparedness.By strengthening community safety and

Figure 15-2: *Proactive measure undertaken by the Meppadi Grama Panchayat*

Formation of Rapid Response Team (RRT)	Enhancement of Evacuation Facilities	Procurement of Fire and Safety Equipment	Emergency Fund Allocation
In 2020, Meppadi Grama Panchayat formed a specialized RRT dedicated to disaster management activities. This team is trained to respond swiftly and effectively to various disaster scenarios, ensuring the safety and well-being of the community.	Each year, the Panchayat has allocated funds to improve the facilities of community halls, schools, and anganwadis, which serve as evacuation camps during emergencies. These enhancements include upgrading infrastructure, ensuring the availability of basic amenities, and improving the overall safety and comfort of these shelters.	Recognizing the importance of preparedness, Meppadi Grama Panchayat has proposed projects to procure essential fire and safety equipment. This initiative aims to equip the community with the necessary tools to handle fire-related emergencies and enhance overall safety measures.	A portion of the Grama Panchayat's own funds has been set aside most years to be utilized for emergency situations. This financial provision ensures that the Panchayat can respond promptly to unforeseen disasters, providing immediate relief and support to affected individuals.

minimizing response times, the Kerala Fire and Rescue Services play a crucial role in building resilience against disasters at the local level.

Volunteerism:
In Kerala, the Aapda Mitra program, Civil Defence, and other community volunteers play a pivotal role in mitigating disaster risks at the local level. The Aapda Mitra program, which translates to "friends during disasters," aims to train and empower community volunteers to serve as first responders during emergencies, equipping them with essential rescue and relief operations skills.

This initiative has successfully mobilized hundreds of volunteers across vulnerable districts, nurturing a culture of volunteerism and local engagement in disaster management.The Civil Defence complements these efforts by providing additional manpower and expertise in emergencies, while local community volunteers contribute invaluable knowledge of their surroundings, facilitating effective communication and coordination during disasters.

Collectively, these groups enhance the resilience of communities in Kerala, ensuring that local populations are better prepared to respond to and recover from disasters. This explains the significant role of the Aapda Mitra program in strengthening community preparedness and response capabilities.

XIII Working Committee Group:
The Disaster Management, Climate Change, Biodiversity Protection, and Environmental Conservation Working Group, established by local self-government bodies, is a dedicated committee focused on addressing the multifaceted challenges posed by hazards, climate change, and environmental degradation.Their endeavours are centered on promoting disaster risk reduction, capacity building, climate resilience, sustainable construction practices, biodiversity protection, and environmental conservation. Through these initiatives, the Working Group seeks to nurture a more sustainable and equitable future.

The Meppadi Grama Panchayat (GP) Working Group is a body of 13 members, responsible for addressing the issues related to hazards, climate change, and environmental challenges in the local area. The group is chaired by a ward member, while the CDS executive serves as the Vice Chairman. The Grama Panchayat Secretary acts as the convener, coordinating the group's activities. Additionally, the working group comprises 10 other members representing different wards within the GP.

Emergency Response Teams (ERTs) constituted by the local self-governments at the ward level,

are indispensable for the effective management of disasters.

Comprised of trained individuals, these teams are equipped to respond to a diverse range of emergencies, including natural calamities, accidents, and public health crises. ERT members play a pivotal role in search and rescue operations, providing medical assistance, distributing relief supplies, and coordinating with other emergency agencies.

Given that most ERT members are integral to the community itself, they possess invaluable local knowledge and insights that contribute significantly to enhanced disaster response efforts. Their involvement in early warning systems and preparedness and response initiatives further strengthens their capacity to contribute meaningfully.

By strengthening community engagement, disaster management plans can be more effectively tailored to local needs, ensuring a more comprehensive and effective approach to disaster risk reduction.

Early Warning and Dissemination

Early warnings are disseminated extensively through advisories issued by national agencies such as the India Meteorological Department (IMD), Central Water Commission (CWC), and the Indian National Centre for Ocean Information Services (INCOIS).

The IMD regularly issues rainfall warnings categorized by district and alert levels as Green, Yellow, Orange, and Red. The Kerala State Disaster Management Authority (KSDMA) has established specific operational procedures that are activated in response to these warning levels.

For example, when an Orange alert is issued, KSDMA activates a predetermined list of groups for disseminating alerts through a variety of channels, including WhatsApp, email, SMS, and other social media platforms.

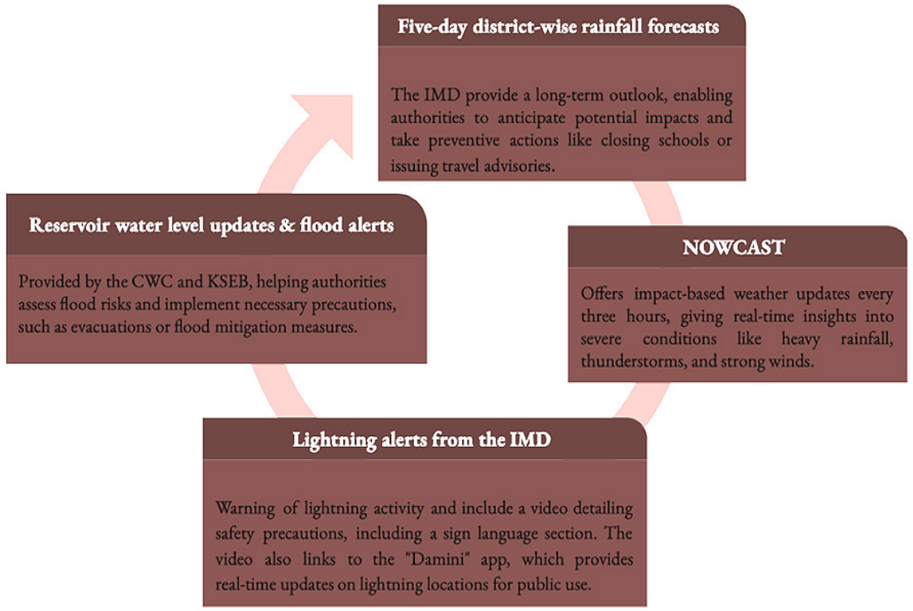


Figure 15-3: *Alerts provided by SEOC*

Figure 15-4: *Government Operated Stations at Wayanad*



KSEOC - DEOC Alert Protocols:
The District Emergency Operations Center (DEOC) is a crucial hub for receiving and disseminating critical weather information. The State Emergency Operations Center (SEOC) provides a variety of alerts to DEOC, which include:

Email and WhatsApp Notifications:
Alerts are disseminated to key stakeholders, including the Hotline, Revenue Department, Fisheries Department, Local Self-Government Department (LSGD), Fire Force, Police, Coastal Police, Irrigation Department, Kerala State Electricity Board (KSEB), District Emergency Operations Centers (DEOCs), road safety authorities, and community groups.

Additionally, notifications are disseminated to IAS and IPS officers, media outlets, and central forces.

Special Directives:
District Collectors receive targeted instructions via email to coordinate localized responses.

Public Warnings:
If strong winds are expected, a special public warning is issued. Additionally, tourism related entities receive specific instructions, and safety guidelines are communicated to the general public, including special instructions for road safety authorities, to ensure widespread awareness and preparedness.

Rainfall Monitoring Stations

Wayanad district has implemented a comprehensive rainfall monitoring network to effectively manage water resources and mitigate potential risks associated with extreme weather events. The district's rainfall monitoring network comprises a combination of government operated and privately owned stations, ensuring wide geographical coverage and timely data collection. The combination of government operated stations and private rain gauges ensures wide coverage and timely data collection. The use of the DM Suit web portal for data entry, visualization, and dissemination facilitates efficient information sharing among stakeholders.

Around 158 Private Rain gauges are strategically located in schools, villages, Tribal Hamlets, plantations, and individual households, providing valuable data from diverse geographical settings.

The rainfall data collected from these rain gauges is meticulously recorded by individuals and organizations who own them. The data is measured on a daily basis and subsequently updated on a WhatsApp group, of which the DEOC is a member, early each morning.

Information Flow

The DEOC serves as a critical hub for receiving and disseminating emergency alerts and warnings. It receives information from various sources, including the IMD and other relevant agencies, through the SEOC. The SEOC, in turn, receives these warnings primarily through official emails.

DEOC receives a range of alerts from SEOC, including district-wise rainfall forecasts for the next five days, impact-based weather forecasts updated every three hours, lightning alerts, reservoir water levels, and flood alerts provided by the CWC and KSEB. These alerts are shared with DEOC through dedicated WhatsApp groups established for alert dissemination.

The DM Suit web portal also serves as the central hub for rainfall data management in Wayanad district. DEOC inputs data from various stations and Individuals, including seven IMD stations that provide real-time updates every 15 minutes and the remaining stations that collect 24-hour average rainfall data. The portal generates 24-hour rainfall output maps on a LSG basis.

Upon receiving these alerts, DEOC carefully analyses the information and forwards relevant warnings to the appropriate nodal officers, fire force, police, LSG officials, and revenue departments. The mode of dissemination varies depending on the severity of the situation. While WhatsApp groups are used for routine alerts, phone calls or in-person communication may be necessary for urgent matters.

The officials responsible for specific areas then proceed to the affected sites for inspections or evacuations as required. This ensures a prompt and effective response to emergencies, protecting lives and property.

Dissemination of Information

DEOC shares weather warnings issued by the IMD and other relevant nodal agencies through official WhatsApp groups and phone communications. These groups include nodal officers from various departments, LSG officials, village officials, and dedicated groups for trained volunteers and local volunteer organizations.

This ensures that timely information reaches a wide range of stakeholders, enabling them to take appropriate actions and mitigate potential risks.

15.3. Preparedness and Mitigation Activities in Wayanad

Disaster Management (DM) Plans

Hospital DM Plans

The Mananthavady District Hospital Disaster Management Plan, formulated in December 2019, serves as an indispensable component of the hospital's preparedness for and response to a variety of emergencies. This comprehensive and systematic approach to disaster management ensures that the hospital can effectively cope with crises and continue to deliver critical healthcare services.

The Plan commences with an overview of the hospital, including its infrastructure, services, and capacity. Subsequently, it identifies and analyzes the types of emergencies that the hospital may encounter, assessing their potential impact on hospital operations and patient care. The document also includes a detailed list of members constituting the Hospital Disaster Management Committee (HDMC) and outlines the structure of the Hospital Incident Response System, delineating the roles and responsibilities of each member. This system ensures a coordinated and efficient response during emergencies.

Furthermore, the Plan describes the facilities and amenities of the Hospital Emergency Operation Centre (HEOC), which serves as the command center during a disaster. Standard Operating Procedures (SOPs) for emergency management are also outlined, including procedures for activating the Emergency Management Plan, ensuring the safe and orderly evacuation of patients, staff, and visitors, and managing mass casualties through triage, treatment, and surge capacity procedures.

The Plan also addresses Standard Operating Procedures for natural hazards within the hospital. Fire prevention and response protocols are established to minimize the risk of fire outbreaks, while earthquake preparedness and response measures are implemented to safeguard the hospital's infrastructure and ensure the safety of occupants during seismic events.

Mock Drill	Location	Year	Objectives	Participants
State-Level Mock Drill for Flood and Landslide Preparedness	All 14 districts	2023	Evaluate the readiness of government departments and agencies in responding to flood and landslide ensuring a comprehensive assessment of the state's disaster response capabilities.	All relevant government departments and agencies
Landslide Mock Drill	Three taluks at Pozhuthana GP and Thavinjal GP	2022	To test the preparedness and response strategies for landslide	Local authorities, emergency response teams, community volunteers
Forest Fire Mock Drill	Muthanna, Sulthan Bathery	2022	Assess forest fire preparedness and response to enhance coordination among various agencies	Forest department officials, fire and rescue services, local volunteers
Drowning Mock Drill	Near Karald Lake	2022	Train RRT members in tourist destinations to respond to water related emergencies	RRT members
School Safety Mock Drill	Six schools across Wayanad	2023	Educate students and staff on fire safety, evacuation procedures, and other emergency response measures	Students, staff, emergency response teams

Table 15-1: *Mock Drills Conducted in Wayanad*

Tribal DM Plans

The Wayanad district comprises 30 tribal colonies dispersed across 10 panchayats, with Meppadi alone housing 4 such communities. To address the distinct needs and vulnerabilities of these tribal populations, individual Tribal Colony Disaster Management Plans have been developed for each of the 10 GPs, with Wayanad being the pioneering district in Kerala to implement such a comprehensive approach.

These DMPs delve into the unique characteristics of each tribal colony, providing detailed insights into their habitats, livelihoods, health status, and basic infrastructure facilities. This in-depth understanding facilitates the development of disaster preparedness and response strategies that are tailored to the specific needs of each community.

Moreover, these Plans chronicle the history of disasters that have affected these tribal colonies, enabling a more nuanced understanding of their vulnerabilities and potential risks. Through a meticulous analysis of disaster, vulnerability, and risk factors, districts can effectively identify potential threats and devise appropriate mitigation measures.

Emergency response systems are outlined in detail within the document, along with a list of disaster management committee members for each colony. This ensures clear lines of communication and coordination during emergencies. Additionally, this document provides contact information for the DEOC, fire force, and other essential emergency contacts, facilitating a swift and effective response. Each colony's location map is also included in the DMPs, providing a clear understanding of their geographical positioning.

Furthermore, specific camp details are provided for each colony, outlining the capacity, amenities, and precise location for accommodating displaced tribal populations during emergencies.

School safety Plans

The DDMA has implemented the School Disaster Management Club (SDMC) initiative to enhance school safety and preparedness in Wayanad. This program is designed to equip young students with essential knowledge and skills to effectively respond to various emergencies. The SDMC club focuses on providing guidelines and safety precautions for students, acknowledging their pivotal role as the future leaders of society.

Through comprehensive training programs, SDMC cadets are instructed on different types of disasters, the responsibilities of the National Disaster Response Force (NDRF), and specific safety measures for earthquakes, such as the "Drop, Cover, and Hold" (DCH) technique. Additionally, students acquire vital first aid skills, including bleeding control, head injury management, and the treatment of common injuries.

The training also encompasses flood rescue techniques, utilizing improvised floating devices, as well as proper lifting and carrying methods for injured individuals. Students are introduced to basic rope knots and the significance of weather-based applications like Mausam, Damini, Sagar Vani, and Bhookamp for staying informed about potential hazards. By equipping students with these essential skills, the SDMC initiative aims to foster a culture of preparedness and empower young people to contribute to their community's safety.

LSG DM Plans

Local Self-Government (LSG) Disaster Management Plans are comprehensive documents tailored to the specific needs of each LSG unit.

These plans analyze the unique disaster profile of each LSG, encompassing geographical, historical, economic, and social factors, to enhance local governments' preparedness and response capabilities. By providing ward-wise infrastructure details, LSG DM Plans offer valuable insights into living conditions and vulnerabilities within the population.

The second chapter of this plan is specifically dedicated to disaster analysis, examining historical events and identifying disaster-prone areas. This chapter is instrumental in understanding the region's unique challenges. Subsequent chapters outline preparation, response, and evacuation plans, including contact information for officials, volunteers, and organizations with relevant resources. These plans also detail Emergency Response Teams (ERTs) for various functions such as evacuation, warning dissemination, search and rescue, shelter management, and first aid.

Furthermore, the LSG DM Plans feature a chapter devoted to disaster-related projects, tailored to the specific needs and vulnerabilities of each LSG unit. These projects, designed for LSGs, Block Panchayats, District Panchayats, and collaborative efforts, aim to enhance capacity and promote DRR. By implementing these initiatives, LSGs can effectively build resilient communities and ensure effective disaster management at the local level.

By addressing potential hazards, assessing vulnerabilities, and developing comprehensive preparedness and response plans, these plans contribute significantly to the overall safety and well-being of local populations.

Capacity and Resources in Wayanad

The disaster response capacity in the area comprises 20 police stations and 3 fire and rescue stations staffed by 118 personnel. The National Disaster Response Force (NDRF) is represented by the nearby 10th and 4th Battalions.Additionally, 200 Aapda Mitra volunteers are available for community-based disaster response.

Capacity	Number
Police Station	20
Fire and Rescue station	3
Number of Fire and Rescue staffs	118
NDRF	10th and 4th Battalion; 30 in Kalpetta during monsoon
Aapda Mitra	200
ERT	• First Aid Team • Shelter management Team • Search-Rescue-Evacuation • Early Warning Dissemination

Table 15-2: *Total Response Resources in Wayanad*

The area is further supported by specialized ERTs that handle first aid, shelter management, search, rescue, evacuation, and early warning dissemination.

Given the prevalent multi-hazard levels in Wayanad district, the number of fire and rescue workers and stations is proportionately insufficient. To enhance the response capacity, there is a pressing need to augment the number of fire and rescue personnel and stations in Wayanad. Moreover, advanced training should be provided to Aapda Mitra volunteers, as they often serve as the first responders.

Wayanad district has established a comprehensive emergency preparedness plan to safeguard the safety and wellbeing of its residents during crises. A crucial component of this plan is the extensive network of 257 evacuation camps strategically distributed across various Local Self-Government (LSG) units.

These camps, designed to provide temporary shelter and essential amenities, can accommodate up to 30,230 individuals, ensuring a robust and effective response to potential emergencies such as natural disasters, civil unrest, or other unforeseen events.

In Meppadi Grama Panchayat alone, there are 24 fully equipped evacuation camps. These facilities can accommodate up to 1,815 individuals, providing a significant capacity to support displaced residents during emergencies. Each camp is equipped with essential amenities and security measures to ensure the comfort and wellbeing of those seeking refuge.When people are relocated to these camps, the LSGD and village officials provide any necessary supplies and support.

The recent Chooralmala incident serves as a testament to the effectiveness of the evacuation camps in Wayanad district. During the heavy rainfall that lasted over seven hours, several families were successfully evacuated to the Vellarimala School, a designated evacuation camp.

The local Panchayat officials provided essential supplies such as blankets, food, and other necessities to ensure the comfort and wellbeing of the displaced residents.

15.4. Post-Disaster Risk and Susceptibility Analysis for Chooralmala

GEOMORPHOLOGICAL

Left Flank Instability: The left flank of Chooralmala has experienced failure, while the right flank, although currently intact, is at risk due to loosen debris, fractured rocks, and a rock wedge in the release area. These factors increase the likelihood of further landslides under heavy rainfall or seismic activity.

Channel Bank Erosion: Significant erosion on steep channel banks and high overburden material poses a risk of bank collapse, potentially leading to additional landslides or blockages. Bank stabilization measures are necessary to mitigate these risks.

Debris Mobilization: The mobilization of debris, including uprooted trees and boulders, indicates a high potential for channel obstruction, requiring continuous management to ensure unobstructed water flow.

SLOPE STABILITY

Steep Slopes: Steep slopes from the release area to Punchirimattom present a high landslide risk, while moderate slopes downstream still require monitoring and potential slope stabilization interventions.

Landscape Changes: The landscape is actively changing due to debris accumulation and the formation of new topographical features, necessitating ongoing assessment and monitoring.

HYDROLOGICAL

Backflow: The occurrence of backflow at sites like Seethammakund suggests the need for improved water management systems to prevent flooding and erosion.

Infrastructure Vulnerability: The destruction of bridges highlights the vulnerability of infrastructure to extreme events, necessitating future designs that can withstand such impacts.

ECOLOGICAL

Vegetation Loss: The stripping of vegetation and

loss of forest cover have increased slope instability, emphasizing the need for reforestation efforts.

Wildlife Habitat Disruption: Landscape changes have disrupted wildlife habitats, increasing the risk of human-animal (elephant) conflicts. Mitigation measures such as wildlife corridors, barriers, and community awareness programs are essential to address this issue.

15.5. Performance Assessment

The performance assessment seeks to identify potential DRR initiatives that authorities, local governments, and community groups can implement to enhance the existing mechanisms and protocols observed during the Chooralmala landslide event.

After meticulous observation, interaction, investigation, and analysis, the designated DRR team concluded that the overall response mechanism was generally effective. The local community, including Aapda Mitra and civil defence volunteers, in conjunction with local rescue organizations, effectively utilized the critical golden hours to rescue victims. However, the complete collapse of the power supply system and lack of adequate lighting significantly impeded rescue operations, leading to an increased death toll.

The following factors exacerbated the impact of the disaster:

1. Reluctance of households to evacuate.
2. Shortage of trained volunteers.
3. Destruction of the bridge and road to the affected area.
4. Failure of communication networks.
5. Limited visibility due to power outages.
6. Misjudgment of risk based on past experiences.
7. Neglect of the current realities of climate change.
8. Vulnerability during sleep hours [5].
9. Lack of safe rescue shelters.
10. Absence of clear demarcation of impact zones through runout models.
11. Inadequate number of fire and rescue workers and stations in relation to the existing hazard levels in Wayanad

To address these gaps and mitigate future disaster situations, urgent attention and interventions must be adopted at the grassroots level with the support of local administrations and community volunteers.

15.6. Disaster Mitigation

To mitigate future disaster situations and address the identified gaps, the following interventions can be implemented:

Non-Structural

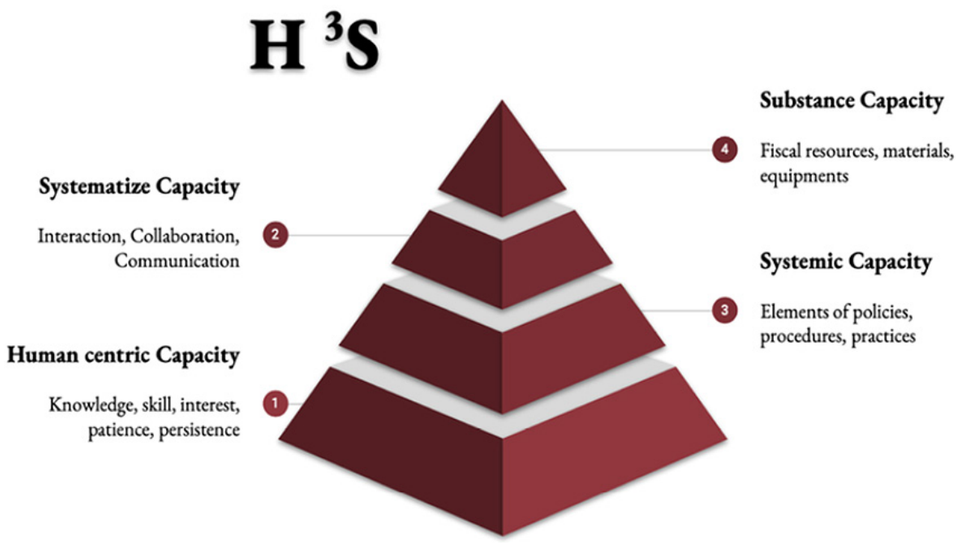
While structural measures such as slope stabilization and drainage systems are crucial for mitigating the effects of landslides, non-structural interventions also play a vital role in enhancing disaster resilience.

The non-structural risk reduction measures can adopt the KSDMA capacity building framework as the methodology that emphasizes the necessity of equipping every individual with essential capacities to adeptly confront, manage, and comprehend diverse spectrum of disaster scenarios.

The capacity-building efforts of KSDMA operate on four distinct levels, guided by the adoption of the H 3S approach. This approach serves as the foundational framework for the development and implementation of all capacity-building programs, projects, and interventions at KSDMA.

[5] *The occurrence of landslide during deep sleep hours significantly impedes effective response efforts due to the reduced alertness and responsiveness of individuals.*

Figure 15-5: *Capacity Building Framework of Kerala State Disaster Management Authority*



H 3S approach for capacity Building at KSDMA [6]

The H 3S approach is a strategic capacity-building framework intended to foster inclusive and need-based training and awareness within communities. The principal objective is to enhance the preparedness of both individuals and the community at large by methodically developing their capacities at different levels.

This approach is tailored to address the diverse needs of diverse stakeholders, ensuring a comprehensive and effective strategy for disaster management.

For Meppadi Panchayat and other locations facing similar hazard conditions, the following non-structural risk reduction measures are recommended to improve community resilience and preparedness:

1. Enhancing Community Engagement and Awareness

Regular Evacuation Drills: Conduct regular community-wide evacuation drills to ensure households understand the importance of prompt evacuation and are familiar with the procedures. By conducting regular drills, people can become familiar with escape routes, emergency assembly points, and communication protocols, ultimately reducing panic and improving the overall efficiency of evacuations during actual crises.

Community Awareness and Education Programs: Launch awareness campaigns focusing on the importance of responding quickly to evacuation orders and understanding the risks associated with disasters, particularly in light of climate change. Use the Community Volunteers to conduct regular training sessions and workshops for residents on recognizing early warning signs of landslides and appropriate emergency

[6] *Kerala State Disaster Management Authority [2023], Keraleeyam 1.11.2023 – 7.11.2023 Capacity Building for Aapda Mitra, Civil Defence Volunteers and Children, Government of Kerala.*

response actions. Initiate campaigns to educate the community about disaster risks and the importance of adhering to land-use regulations.

Conducting Volunteer Training Programs: Since the community serves as the first responders in emergencies, it is crucial to enhance the resilience and capabilities of local communities. Establish comprehensive training programs for volunteers, covering essential skills such as first aid, emergency response, and evacuation assistance. Additionally, incorporate specialized training focused on night-time evacuations to ensure preparedness for all scenarios.

Aapda Mitra & Civil Defence Expansion: Expand the Aapda Mitra and Civil Defence initiative to increase the number of trained volunteers in vulnerable areas. Provide sufficient rescue equipment and replace damaged and lost equipment during rescue time. Since the Chooralmala landslide was a unique experience for the volunteers, 'Rope Rescue' training should be provided.

Constitution of Community Disaster Response Committee (CDRC): Communities are often the first responders to disasters, and the establishment of Community-Based Disaster Response Committees can significantly enhance their preparedness and response capabilities.

Communities often possess in-depth knowledge of their locality, enabling them to tailor their response efforts to specific needs and vulnerabilities. By including representatives from Indigenous communities, such as tribal colonies, in these committees as well, we can more effectively engage and support these often marginalized populations. These communities may be particularly vulnerable to disasters due to their unique geographic locations, socio-economic conditions, and cultural practices and their reluctance to listen to outsiders can hinder evacuation efforts during emergencies.

However, by incorporating Indigenous representatives into CDRCs, communities can establish trust and build relationships, facilitating more effective communication and coordination. Furthermore, these representatives can provide valuable insights into cultural practices, traditional knowledge, and local vulnerabilities, enabling CDRCs to develop tailored response plans.

Community-based preparedness planning: Following the community awareness programs; trained community volunteers must develop community-based preparedness plans. On the day (on anniversary) of disaster (30th July) they must work with the community to conduct local hazard assessments, identify and develop evacuation plans, and conduct periodic drills, including a landslide drill.

Identifying Community Influencers: Influencers can serve as powerful conduits for disseminating information about potential hazards, early warning systems, and emergency protocols to a broad audience. Their extensive reach ensures that critical messages reach vulnerable populations who may not have access to traditional communication channels. By mobilizing communities to take action, such as participating in evacuation drills, preparing emergency kits, and supporting local disaster response efforts, influencers can play a vital role in enhancing community resilience. Their understanding of local customs and traditions enables them to tailor communication efforts to meet the specific needs of diverse communities.

Community Volunteers: The immediate response to the landslide and debris flow event in Mundakkai and Chooralmala has shown the importance of Community volunteers such as Aapda Mitra and Civil Defence, who saved many lives. The fire force personnel who interacted with the PDNA team also reiterated that the way forward will be to increase the number and capacities of community volunteers. It is recommended that a long-term plan be developed to increase the number of community volunteers and provide induction and refresher training for them through the Fire and Rescue Services.

ARR-T For Volunteerism Framework [7]

Volunteerism, the selfless act of dedicating time, skills, and resources for the betterment of others transcends the boundaries of social, cultural, and geographical divides, embodying the universal language of empathy. In times of crisis, be it natural disasters, conflicts, or pandemics, volunteers emerge as the first responders, offering solace and aid to those caught in the throes of adversity. However, it is noteworthy that volunteerism often tends to be more prevalent only during the occurrence of an actual disaster.

In line with SENDAI's primary target of reducing disaster mortality, it becomes imperative for the community to extend volunteer efforts beyond just response phases and incorporate them into the preparedness processes of disaster management. This proactive approach holds the potential to enhance the community's resilience in the face of catastrophic situations in the long run.

In pursuit of this objective, in Keraleeyam 2023 of Government of Kerala, the Kerala State Disaster Management Authority, introduces a capacity-building training program for Aapda Mitra and Civil Defence volunteers. The primary goal of this initiative is to promote and propagate the significance of volunteerism not only during the immediate aftermath of a disaster but also in the pre and post-phases of disasters. By encouraging active involvement in preparedness and recovery, the program aims to instil a culture of volunteerism that contributes to the overall resilience and wellbeing of the community.

However, an insightful observation from the working group report for disaster management spanning 2022-2027 emphasizes that many existing plans are rooted in the experiences of past disaster events in Kerala. This reliance on historical data indicates a potential gap in adequately preparing for future events. To strengthen resilience, prevention, and preparedness, a crucial pivot towards community capacity building is imperative. The emphasis, in this case, is on human-centric capacity building, acknowledging the significant role that individuals play as volunteers in effective disaster response.

The ARR-T (Awareness, Response, Resilience and Training) framework for volunteerism has been developed to align with the specific goals and objectives identified for KSDMA's Keraleeyam 2023. This framework serves as a strategic guide to enhance the capabilities of Volunteers and is particularly tailored to address the unique challenges presented by disaster management in the state. That delineates how capacity-building initiatives for volunteers, encompassing targeted training in awareness, response, and resilience, can significantly strengthen disaster management efforts by promoting prevention, preparedness, and recovery.

Awareness training: plays a critical role in the prevention and preparedness phases of disaster management by empowering volunteers with the knowledge, skills, and mindset needed to identify risks, take proactive measures, and respond effectively to emergencies.

Response training: strengthening their preparedness in the preparedness phase, volunteers become a reliable and responsive force, capable of minimizing casualties, damage, and socio-economic disruptions resulting from unforeseen events.

Resilience training: emphasizes the psychological well-being of volunteers, teaching them coping mechanisms to deal with stress, trauma, and the challenges posed by disaster-affected communities. Volunteers are trained to serve as pillars of support, offering not only physical assistance but also emotional support to those affected. Understanding the long-term impact of disasters on communities, resilience training ensures that volunteers are prepared for the complexities of the recovery phase .

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[7] Kerala State Disaster Management Authority [2023], Keraleeyam 1.11.2023 – 7.11.2023 Capacity Building for Aapda Mitra, Civil Defence Volunteers and Children, Government of Kerala.

Figure 15-6: *ARR-T For Volunteerism Framework [Source: KSDMA]*

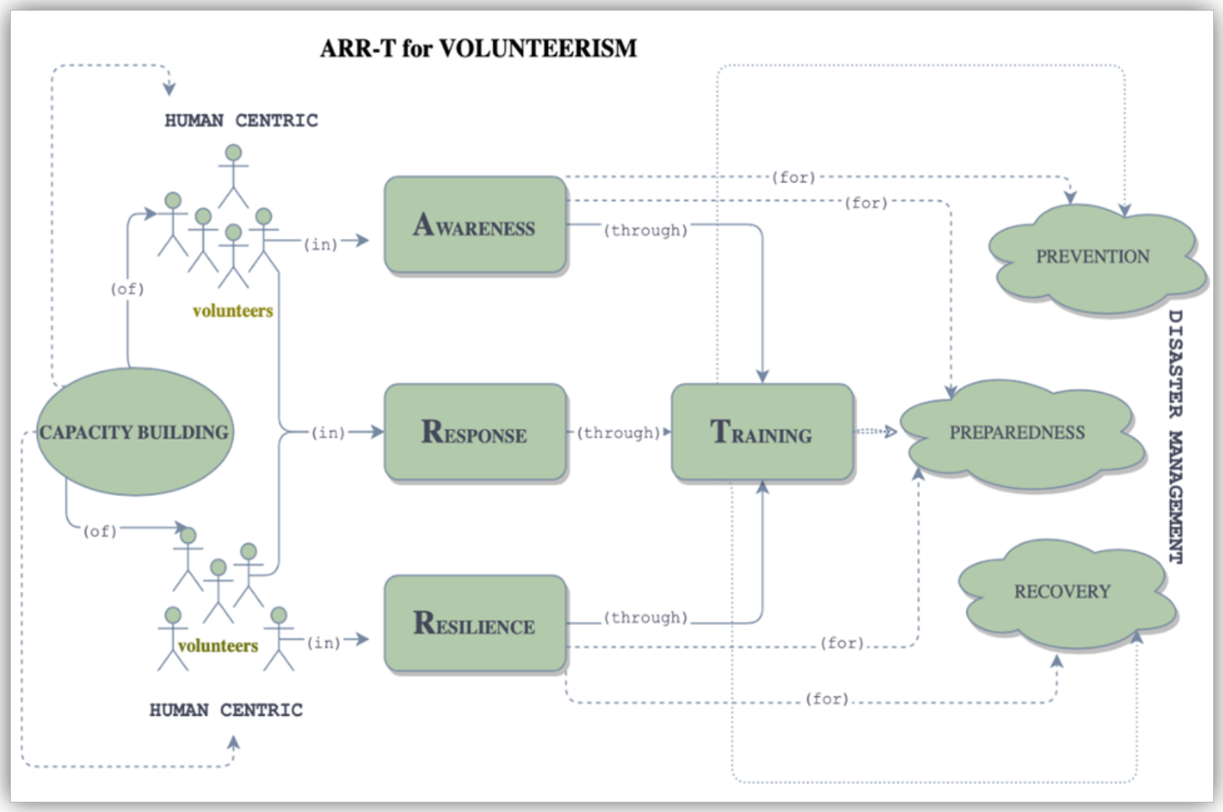
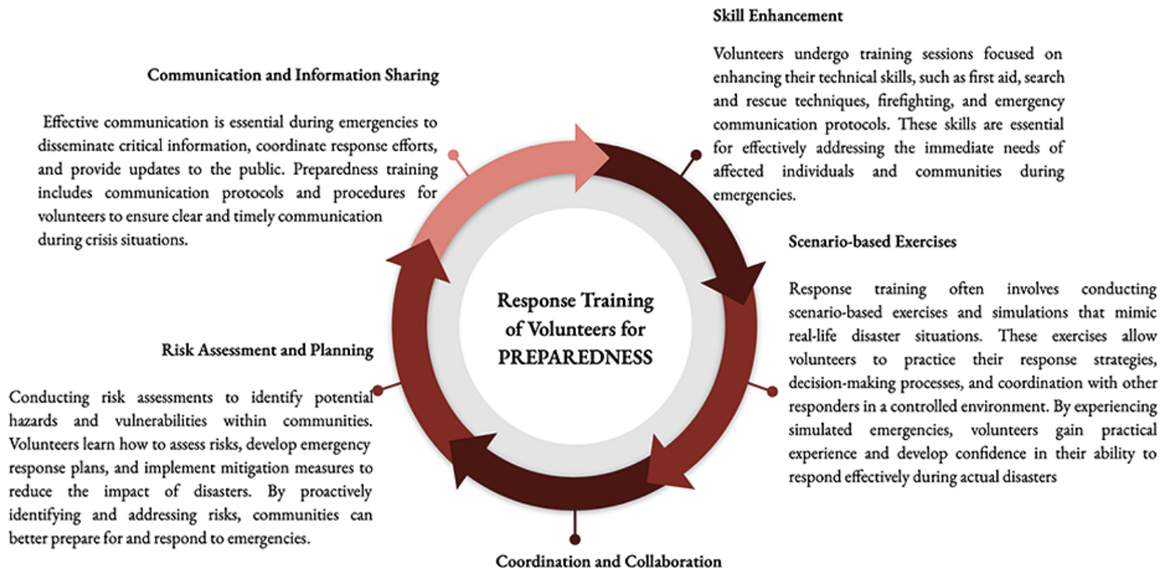


Figure 15-7: *Response Training of Volunteers for Preparedness [Source: KSDMA]*



2. Improving Communication Systems

Backup Communication Networks: Establish redundant communication systems, such as satellite phones and portable radios, to maintain communication during power failures or network disruptions.

Community Communication Plans: Develop and disseminate clear communication plans, including neighbourhood focal points for information sharing in the event of network failures.

3. Power and Lighting Solutions

Emergency Power Supplies: Install emergency generators and battery powered lighting in key community areas to ensure visibility during power outages.

Solar-Powered Lighting: Promote the use of solar-powered lanterns and streetlights in vulnerable communities to provide lighting during night time disasters.
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4. Risk Assessment and Climate Change Adaptation

Updated Risk Assessments: Regularly up-date hazard and risk assessments to reflect current climate change realities, incorporating new data and scenarios.

Climate Adaptation Programs: Implement community based climate adaptation programs that focus on building resilience to the changing climate, such as flood resistant infrastructure and improved drainage systems.

5. Monitoring and Early Warning Systems

Enhanced Early Warning Systems: Upgrade early warning systems to ensure they reach communities even during night time hours, possibly through loudspeakers, sirens, or automated phone alerts.

Real-Time Monitoring: Install real-time monitoring equipment in vulnerable areas to detect early signs of landslides or other disasters and trigger timely warnings.

Environmental Sensors: Monitoring Network: Install IOT-based sensors for monitoring Air Quality Index, Water Quality and Soil Moisture Content.

6. Psychological Preparedness and Response

Sound Sleep Hours Alerts: Develop a specialized alert system for night-time disasters that considers sound sleep hours, using loud, easily recognizable alarms to wake residents quickly in emergencies.

Community Support Programs: Create programs that address the psychological impact of past disasters and encourage a proactive approach to risk management rather than reliance on past experiences.

7. Need for New Fire Stations and Specialized Equipment

Wayanad, a picturesque district in Kerala, is particularly vulnerable to geographic isolation during the monsoon season. The heavy rainfall characteristic of this period often results in landslides, road blockages, and flooding, significantly disrupting transportation and communication links with the outside world. Major roads leading to Wayanad are susceptible to landslides and floods, exacerbating the challenges faced by emergency services, including fire and rescue operations, in reaching affected areas promptly. Given the district's hilly terrain and dense forests, the impact of monsoon rains can be intensified, leading to prolonged isolation of communities and a sole reliance on the existing capacity of fire and rescue services within the district.

In light of these challenges, there is an urgent need for the establishment of three new fire stations strategically located in Pulpally, Vythiri, and Thodarnadu. These locations have been selected based on their spatial coverage and proximity to high-risk areas prone to disasters during the monsoon season. Each fire station would require an investment of approximately 4 crores (40 million rupees), which will cover the construction costs, equipment, and staffing needs.

The presence of these new fire stations will not only enhance the capacity for rapid response during emergencies but will also ensure a more equitable distribution of resources across the district. Specialized equipment, such as all terrain vehicles and advanced rescue tools, should be included in the inventory to facilitate effective operations in challenging environments until external support can arrive.

Increasing Staff Strength and Space Expansion

To complement the establishment of new fire stations, it is essential to increase the existing staff strength and expand the operational space of current facilities. The existing workforce may be insufficient to manage the anticipated increase in demand for services during peak disaster periods. Recruitment drives should focus on hiring additional personnel trained in disaster response and management, ensuring that they are equipped with the skills needed to operate effectively under pressure.

Additionally, expanding the physical space of fire stations to accommodate more personnel, training facilities, and storage for specialized equipment is critical. This will provide a functional environment for training and operational readiness, enabling fire personnel to respond to emergencies efficiently.

8. Health and Risk Insurance for Rescue Personnel

Given the inherent risks associated with the work of police and fire personnel, it is vital to introduce an additional health and risk insurance scheme. This scheme should specifically address the unique challenges faced by these workers during emergency situations, including exposure to hazardous environments and the potential for injury. Such a policy would provide peace of mind for personnel and their families, ensuring they are supported in the event of an accident or health issue related to their work.

9. Protection of Personal Belongings

Another critical issue is the loss and damage of personal belongings of fire personnel during rescue operations. Items such as mobile phones, glasses, and other personal effects are often lost or damaged in the chaos of emergency response.

Implementing policies that offer compensation or insurance for personal belongings can help mitigate the financial burden on personnel, allowing them to focus on their critical work without the worry of personal losses.

10. Central Force Base Camp in Wayanad

In addition to enhancing fire and rescue capabilities, establishing a central force base camp in Wayanad can provide further support during emergencies. The presence of a central force can facilitate rapid mobilization of resources and personnel during disasters, complementing the efforts of local fire and rescue teams.

The central force can offer specialized training, logistics support, and additional manpower during peak monsoon periods when the risk of disasters is heightened. Furthermore, the establishment of a base camp can serve as a strategic location for coordinating disaster response efforts, enabling a more effective and organized approach to emergency management.

11. Rope Rescue Training for more Personnel's

Rope rescue training equips individuals with the essential skills that are required to efficiently conduct rescue operations in challenging environments like mountains or cliffs safely and efficiently. Through this training participants are taught knot tying, rope rescue techniques, equipment usages and safety protocols to become more proficient in rescuing people in tricky situations.

This training empowers individuals to safely navigate challenging terrain, execute complex rope manoeuvres, and equips more personnel with the necessary skills and knowledge to respond more efficiently to emergencies, potentially saving lives and minimizing risks.

12. Rescue and DRR Training for off road Jeep drivers and JCB drivers

Equipping Jeep and JCB drivers, who are vital in rescue operations in challenging terrains like Wayanad, with the necessary skills and knowledge is crucial for maximizing the effectiveness of rescue efforts during the critical "golden hours."Unlike untrained civilians, trained professionals can maintain composure and make calm, informed decisions in the face of emergencies, potentially saving more lives.

13. Drone Training and Drones at DDMA for immediate Search and Rescue

Incorporating drone technology and training into the operations of the DDMA will significantly enhance the district's capabilities for immediate search and rescue during disasters. By equipping personnel with the necessary skills and tools, the DDMA can improve its response time, increase the likelihood of successful rescues, and ultimately save lives. As technology continues to evolve, integrating drones into disaster management strategies will become increasingly essential for effective emergency response. Engaging with local communities to raise awareness about drone operations can help build trust and encourage cooperation during emergencies.

The Kerala State Disaster Management Authority (KSDMA), in collaboration with the Additional Skill Acquisition Programme Kerala (ASAP), has launched a drone training program for Aapda Mitra and Civil Defence volunteers across the state. The first phase of this training has been successfully completed for volunteers from Kasaragod. With the support of the National Disaster Management Authority (NDMA), this initiative can be expanded and integrated into the broader disaster management framework.

14. Observing Landslide Day on 30th July

The state must observe a landslide day to raise awareness about the risks and impacts of landslides, particularly in regions prone to such natural disasters. This day must be dedicated to educating the public, especially those living in vulnerable areas, about the importance of preparedness and the measures that can be taken to mitigate the effects of landslides. Activities on this day should be led by disaster management authorities, geologists, and environmental experts.The observance of Landslide Day underscores the state's commitment to enhancing resilience against landslides through education, planning, and community involvement.

On Landslide Day, various activities can be conducted to raise awareness and enhance preparedness for landslide risks:

i. **Educational Seminars:** Experts can deliver talks on landslide causes, warning signs, and preventive measures, focusing on the local geography and risk factors.

ii. **Community Workshops:** Hands-on workshops can teach community members how to create landslide-resistant infrastructure, maintain proper drainage, and implement soil conservation techniques.

iii. **Mock Drills:** Conducting mock evacuation drills helps residents practice safe and efficient responses in case of a landslide, ensuring they know evacuation routes and procedures.

iv. **Awareness Campaigns:** Distribute pamphlets, posters, and online content that highlight landslide risks, safety tips, and emergency contact information. Local media can also run special segments on landslide awareness.

v. **Tree Plantation Drives:** Organize tree planting activities in landslide prone areas to promote reforestation, which helps stabilize soil and reduce landslide risks.

vi. **School Programs:** Engage students through interactive sessions, quizzes, and art competitions focused on landslide awareness, helping them understand the importance of disaster preparedness.

vii. **Field Trips:** Arrange guided field trips to landslide-prone areas, where geologists can explain the local landscape, landslide history, and current prevention efforts.

viii. **Early Warning System Demonstrations:** Demonstrate how early warning systems work and how communities can benefit from timely alerts, ensuring that residents are familiar with the signals and actions to take.

ix. **Exhibitions:** Exhibitions on Landslide Day can be a dynamic way to engage the public with visual and interactive displays. These exhibitions can feature maps highlighting landslide prone areas, before-and-after photos of affected regions, and models that demonstrate the mechanics of landslides.

Incorporating technology, such as augmented reality simulations, can make the experience more immersive, allowing visitors to better understand how landslides occur and their potential impacts. Additionally, showcasing the latest technology used in landslide monitoring, such as sensors, drones, and GIS mapping, can educate attendees on how these tools are critical in predicting and managing landslide risks. Exhibits could also include a historical timeline of significant landslides in the state, providing context through personal stories, news clippings, and government reports, while highlighting successful mitigation projects like reforestation and slope stabilization efforts.

x. **Experience sharing:** Landslide Day can be a powerful tool for raising awareness and building community resilience. Survivor stories, where individuals who have lived through landslides share their experiences, can provide deep insights into the challenges faced during such disasters and underscore the importance of preparedness.

Expert panels, featuring geologists, disaster management professionals, and environmental scientists, can offer valuable information on landslide causes, early warning systems, and effective response strategies. Additionally, hearing from community leaders and volunteers who have been involved in disaster response efforts can inspire and inform others on best practices for relief and rehabilitation. Interactive sessions that encourage community members to share their own experiences and ideas can further strengthen local preparedness and foster a collective approach to managing landslide risks.

These activities not only educate the public but also foster a sense of community and collective responsibility in managing landslide risks. The activities collectively aim to empower communities with knowledge and skills to reduce landslide risks and respond effectively in case of an emergency.

15. Digitalization of documents for vulnerable communities

Digital documents are less likely to be lost, damaged, or destroyed during disasters like floods, fires, or landslides. Digitalization of documents for vulnerable communities in hazard-prone areas is a crucial step in improving disaster response and recovery efforts. By converting important documents such as identification papers, land deeds, health records, and insurance policies into digital formats, these communities can ensure the safety and accessibility of essential information even in the aftermath of a disaster.

During disaster response, digital records can facilitate quicker identification of individuals and verification of their entitlements. This can streamline the distribution of aid, such as relief materials, financial assistance, and housing, ensuring that the most vulnerable receive help promptly. Digitizing documents encourages individuals to think critically about the importance of securing their vital records. This proactive step can significantly reduce stress and confusion during the recovery phase. LSGIs, village offices and Akshaya centers can act as a nodal agency for providing the service of digitizing the documents in vulnerable areas at household level.

16. Locker facilities at local and regional levels

Establishing locker facilities at local and regional levels can significantly reduce evacuation time during disasters, particularly in hazard-prone areas. These facilities would serve as secure, accessible storage spaces where community members can safely store essential items such as important documents, emergency supplies, and valuables. Knowing that their important documents and valuables are safely stored can reduce panic and stress during an evacuation. This can lead to a more orderly and efficient evacuation process, minimizing chaos and confusion. By providing a reliable place to store important items, locker facilities contribute to the overall resilience of the community. They ensure that even after a disaster, residents have the necessary resources to begin the recovery process swiftly.To implement these locker facilities, local governments and disaster management authorities could collaborate with community organizations to identify suitable locations, such as community centers, schools, or community buildings. These facilities should be accessible, secure, and wellmaintained. Additionally, public awareness campaigns could educate residents about the importance

of using these lockers and how to access them in an emergency.

17. Providing an honorarium for Aapda Mitra volunteers & community members involved in disaster response

Providing an honorarium for Aapda Mitra volunteers and community members involved in disaster response can be a significant step in recognizing and rewarding their contributions. Aapda Mitra volunteers, who are trained to assist in disaster response, play a crucial role in helping communities during emergencies such as floods, landslides, and other disasters. Offering them a financial honorarium can have several benefits. An honorarium serves as a formal recognition of the time, effort, and risks taken by volunteers. It can motivate them to remain committed to their roles and encourage others in the community to participate in disaster response initiatives. Many volunteers may have to take time off from their regular jobs or personal responsibilities to assist during disasters. An honorarium helps compensate for this time, ensuring they do not face financial hardship due to their volunteer work.

Offering an honorarium can strengthen the relationship between disaster management authorities and local communities. It shows that the efforts of volunteers are valued, fostering greater trust and cooperation in future disaster response activities.By providing financial incentives, disaster management programs can retain experienced volunteers who have undergone training and have the necessary skills to assist effectively during emergencies. In many cases, volunteers themselves may come from vulnerable backgrounds. An honorarium can provide them with financial support that may be critical for their own families' wellbeing, particularly in the aftermath of a disaster.

The honorarium could be provided by the government, through disaster management funds, or supported by IAGs/NGOs and CSR initiatives. The amount should be fair and reflective of the contributions made by the volunteers as decided by the Kerala Fire and Rescue Services. Additionally, clear guidelines and transparent processes should be established to ensure that the honorarium is distributed equitably and efficiently.

18. Family Emergency kit at every household

Establishing an emergency kit at household level in highly vulnerable areas is essential for enhancing disaster preparedness and resilience among communities at risk of natural disasters. An effective emergency kit ensures that individuals and families have access to critical supplies and resources in the immediate aftermath of a disaster, allowing them to respond effectively and safeguard their wellbeing. Key Components of an Emergency Kit is provided by KSDMA [***Figure 15-8***].

19. Risk Communication using posters, stickers and handouts

Effective risk communication is essential for raising awareness and promoting safety in communities, especially in the context of disaster preparedness and response. Using stickers and handouts as tools for communication can enhance visibility and retention of important information among community members. Placed in high traffic areas of homes, such as door frames, ensuring that critical information is always visible to family members. This constant reminder can help reinforce safety messages and preparedness actions.In the language which the concerned community can understand, these handouts summarize essential information, such as emergency contacts, evacuation routes, and preparedness tips, making it easy for individuals to access vital details at a glance during an emergency. Unlike paper handouts that may be easily lost or damaged, a durable material which can withstand the test of time, ensures that important information remains accessible.

20. Landslide Hazard Zonation Maps

Landslide hazard maps are essential for emergency planning and response, enabling authorities to prioritize evacuation routes and allocate resources effectively. Develop landslide hazard zonation maps of adequate scale (at least 1:10000) for vulnerable areas to inform planning decisions.

21. Land Use Planning and Regulation

By adhering to landslide hazard zonation maps and strategically locating new developments in



Figure 15-8: *Components of an Emergency Kit Prepared By KSDMA* [8]

[8] *https://sdma.kerala.gov.in/wp-content/uploads/2020/09/Emergency-Kit-2020-PDF-30092020-1.pdf*

safer areas, governments can effectively mitigate the risk of property damage, loss of life, and economic disruption associated with landslides.

22. Landslide Risk Mitigation Committee

At the district level, a "Landslide Risk Mitigation Committee' is recommended to be established comprising engineers, geologists, architects, urban planners, and utility service professionals from both government and private sectors. This committee will help create policies and develop a comprehensive long-term plan to reduce landslide risks in mountainous areas of Wayanad district. In Mizoram, for example, the Aizawl Municipal Corporation (AMC) has implemented several strategies to mitigate landslide risks in its jurisdiction, including establishing a Landslide Policy Committee that developed a risk reduction strategy known as the 'Roadmap to Stability.'

23. Monitoring and Reporting

To improve monitoring and reporting of weather related hazards in Meppadi, it is essential to establish Automatic Weather Stations (AWS) and community-level monitoring stations.AWS would provide real-time monitoring of critical meteorological parameters such as rainfall, temperature, humidity, and wind speed, essential for predicting extreme weather events that could trigger landslides and debris flows. Deploying a network of AWS across Meppadi would significantly improve local forecasting capabilities and facilitate timely alerts for the community. At the community level, efforts should be made to establish more rain gauges and community monitoring locations, and train community members to monitor rainfall and soil conditions, and report any changes to local authorities for timely action. The community volunteers who are engaged in monitoring and daily reporting can be provided with a monthly remuneration of INR 1000/month.

24. Landslide Runout Models

Lack of a runout model in Chooralmala caused challenges assessing the potential impact of the landslide. The runout models for landslides need to be developed are crucial tools used to predict the potential movement and deposition of landslide materials after a failure event. These models help assess the risk to people, infrastructure, and the environment by simulating how landslide debris may travel and settle. These models help in understanding the dynamics of landslides and can inform risk assessment and mitigation strategies.

25. Indigenous Knowledge "Disseminating Indigenous Knowledge for Disaster Resilience (DIKDR)"

On the 2023 International Day for Disaster Reduction (IDDR), the KSDMA unveiled a framework designed to empower communities. This framework, titled "Disseminating Indigenous Knowledge for Disaster Resilience" (DIKDR), aims to leverage communities' inherent knowledge of indigenous practices to enhance their ability to adapt and thrive in the face of disasters.

DIKDR ***Figure 15-9*** refers to the "deliberate and systemic sharing, preservation, and promotion of traditional culturally embedded knowledge and practices held by communities. This process aims to empower communities and societies by leveraging their time tested percipience, ecological understanding, and adaptive strategies to enhance their disaster resilience, thereby contributing to participatory community centric disaster management." The strong connection between indigenous knowledge and disaster risk reduction initiatives stems from community's intimate relationship with their natural environment. However, defining and identifying indigenous knowledge can be challenging because it often manifests as a lifestyle or cultural ethos, rather than a set of explicit tools or initiatives.

Lessons learned from past disasters in Kerala and around the globe highlight the value of well-established and proven indigenous knowledge practices. These practices have demonstrably benefited communities in various disaster situations. Nevertheless, scientific validation remains crucial when integrating indigenous knowledge into disaster resilience efforts. The DIKDR framework as mentioned in ***Figure 15-9*** addresses this need by bridging the reliability gap in disseminating indigenous knowledge for disaster preparedness and response.It functions through the following interconnected stages:



Identification
The process begins with identifying and documenting indigenous knowledge and practices related to disaster risk reduction. This involves engaging with community members to uncover their traditional wisdom and understanding of natural hazards, coping mechanisms, and early warning systems.



Time-Tested Knowledge & Practices
The identified knowledge and practices are assessed for their relevance and effectiveness in the context of disaster resilience. Those that have been tested over time and proven to be effective are prioritized for further exploration.



Understanding
A deeper understanding of the identified knowledge and practices is developed through analysis and interpretation. This involves examining how these practices are embedded in cultural values, worldviews, and social structures.



Adaptive Strategies
Based on the understanding of indigenous knowledge, adaptive strategies are developed. These strategies aim to integrate traditional practices into modern disaster management approaches, tailoring them to specific community needs and contexts.



Capacity Building
Capacity building initiatives are implemented to empower communities to utilize indigenous knowledge effectively. This includes training and education programs that equip community members with the skills and knowledge necessary to implement and adapt traditional practices.



Participatory Community-Centric Initiatives
The DIKDR framework emphasizes the importance of participatory community-centric initiatives. By involving communities in all stages of the process, the framework ensures that the identified knowledge and strategies are relevant, culturally appropriate, and sustainable.



Sharing, Preservation, & Promotion
The framework promotes the sharing, preservation, and promotion of indigenous knowledge to ensure its continued relevance and accessibility. This involves documenting and disseminating traditional practices, preserving cultural heritage, and raising awareness of the value of indigenous knowledge in disaster resilience.



Building Disaster Resilient Communities
Through the implementation of these steps, the DIKDR framework aims to build disaster-resilient communities. By empowering communities with indigenous knowledge and supporting their capacity to adapt and respond to disasters, the framework contributes to enhancing community resilience and reducing vulnerability.

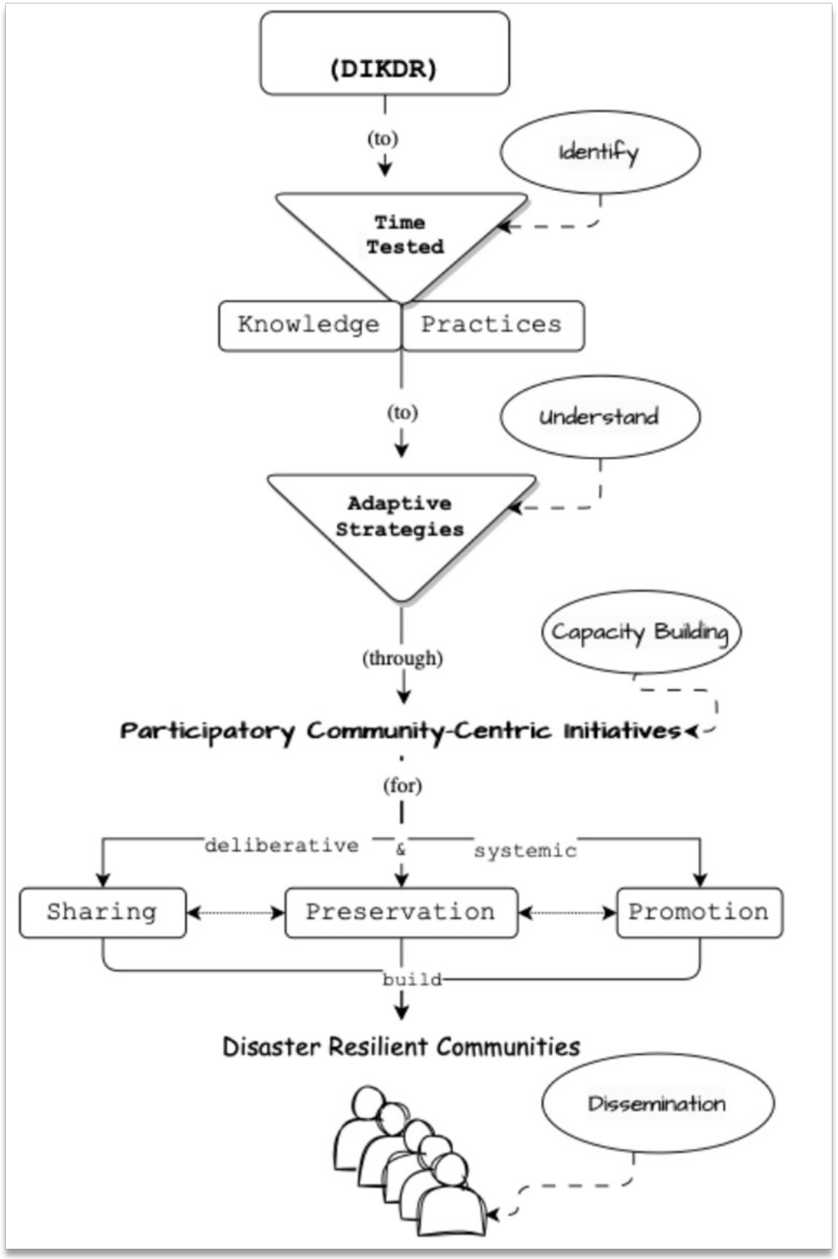

Figure 15-9: *DIKDR FRAMEWORK - (Disseminating Indigenous Knowledge for Disaster Resilience) [Source: KSDMA]*

Additional Considerations

Ethical Considerations

Respect for Cultural Heritage: The DIKDR framework should prioritize the ethical and respectful treatment of indigenous knowledge, ensuring that it is not misappropriated or exploited.

Documentation & Preservation

Comprehensive Documentation: Developing comprehensive documentation of indigenous knowledge, including oral histories, traditional practices, and cultural narratives, is crucial for preserving and transmitting this valuable heritage.

Digital Preservation: Utilizing digital technologies to preserve indigenous knowledge can ensure its accessibility and longevity.

> *"It is noteworthy that the Paniya community in Punchirimattam and Erattukund Hamlets suffered no fatalities during the landslide. While the Punchirimattam community sought refuge in a shelter and the surrounding forest upon the initial landslide, the Erattukundu community demonstrated remarkable resilience by retreating to natural caves within the forest. This incident underscores the critical importance of acknowledging and integrating the indigenous knowledge of these communities regarding safe havens within their environment."*

26. GO – NGO Co-ordination - Mainstreaming the IAGs (Inter Agency Groups)

Lessons learned from previous disasters underscore the challenges associated with ensuring sustainable recovery and rehabilitation. The perpetuating issue of sustainability for humanitarian organizations and their ongoing support to affected communities remains a pressing concern. To address these challenges, collaboration between state government mechanisms and District Inter-Agency Groups (IAGs) is paramount.

District IAG members, with their deep-rooted presence and long-standing engagement within local communities, are uniquely positioned to facilitate sustainable disaster management efforts. To ensure effective coordination among various humanitarian agencies responding to



Figure 15-10: *The District IAG GO-NGO Coordination Desk at Wayanad DEOC*



Figure15-11: *Strategic Action Plan adopted in Wayanad for IAG - GO NGO Coordination [Source: KSDMA]*

Meppadi landslide, the State IAG has developed a framework [***Figure 15-12***] that emphasizes the importance of collaboration between state government mechanisms, various humanitarian stakeholders, and IAGs in promoting sustainable humanitarian responses.

In a significant step towards enhancing disaster response and recovery efforts, the state IAG has constituted the District IAG GO-NGO Coordination Desk at the Wayanad district administration. This initiative aims to support effective collaboration between government agencies, non-governmental organizations (NGOs), and civil society Organizations (CSOs) in the aftermath of the devastating Chooralmala landslide.

The IAG, formed under the direction of the State and District Disaster Management Authority, has been instrumental in coordinating efforts since the disaster struck. From the initial rescue operations to providing essential supplies and supporting relief camps, the IAG has played a crucial role. By bringing together diverse stakeholders, the IAG GO-NGO Coordination Desk can prevent duplication of work and ensure optimal utilization of resources.

The newly established coordination desk serve as a central hub to channelise supports from international, national, and local NGOs, as well as CSR funding agencies. An online form has been created to facilitate the submission of proposals and offers of assistance. Organisations can also contact the coordination desk directly through the IAG control room number.

This collaborative effort, led by the KSDMA, DDMA, IAG Wayanad supported by UNICEF, and Sphere India, signifies the commitment to providing comprehensive and timely support to the affected communities. Through this GO-NGO coordination efforts in all the phases of disaster management both in terms of services and funding was able to assure and bring forth lots of collaborations and convergences.

Following is the strategic action that outlines a clear focus on establishing effective coordination between government organisations (GOs) and non-governmental organizations (NGOs) at the district level IAG.

By adopting these recommendations, the District IAG GO-NGO Coordination model contextualised by the state IAG can serve as a valuable tool for promoting sustainable disaster management practices and enhancing the resilience of communities affected by disasters.

Collaboration Transcends Unity Framework for Sustainable Humanitarian Support [CTU Framework for SHS]

Based on the learnings from the GO-NGO Coordination through IAG, the CTU Framework for SHS is a theoretical framework that posits that effective humanitarian response and recovery necessitate a collaborative approach that transcends traditional notions of unity[10].

The framework emphasizes the significance of sustainable collective collaboration, coordination, and shared ownership among government agencies and humanitarian stakeholders in building back better after disasters.

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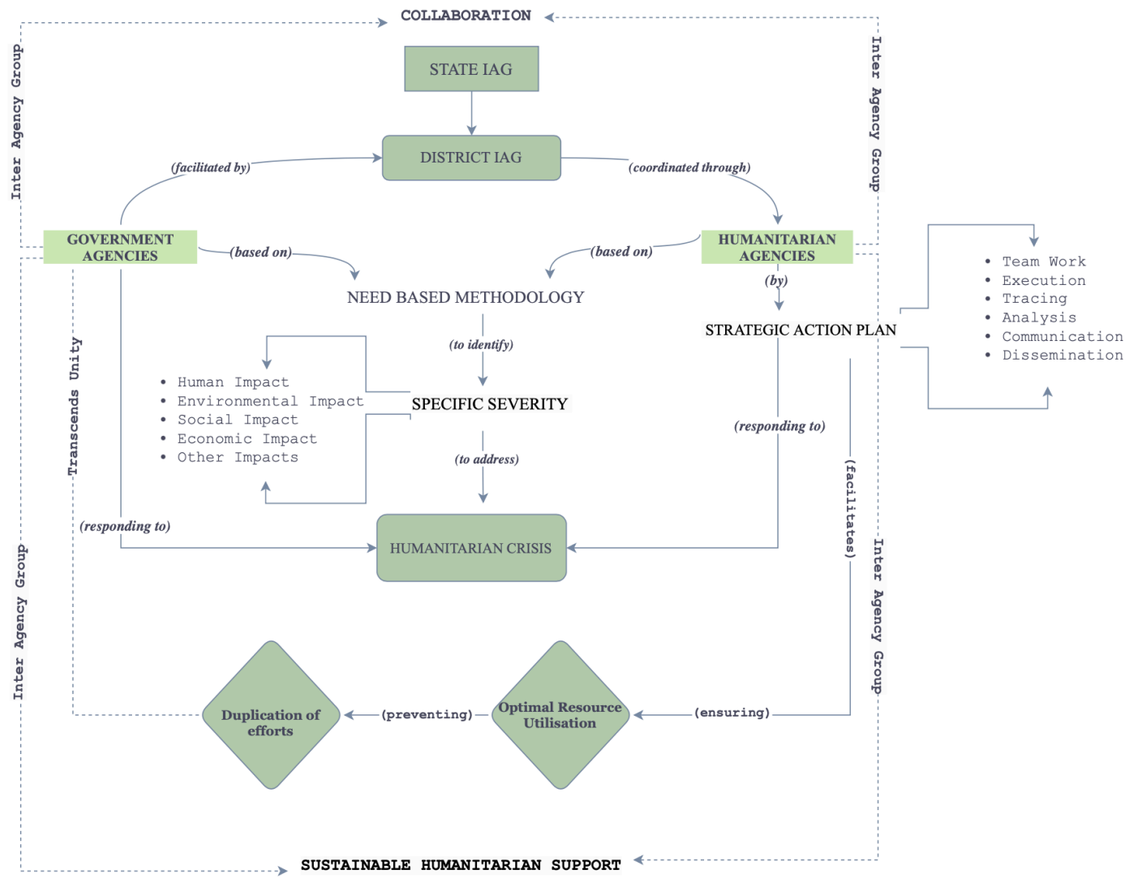
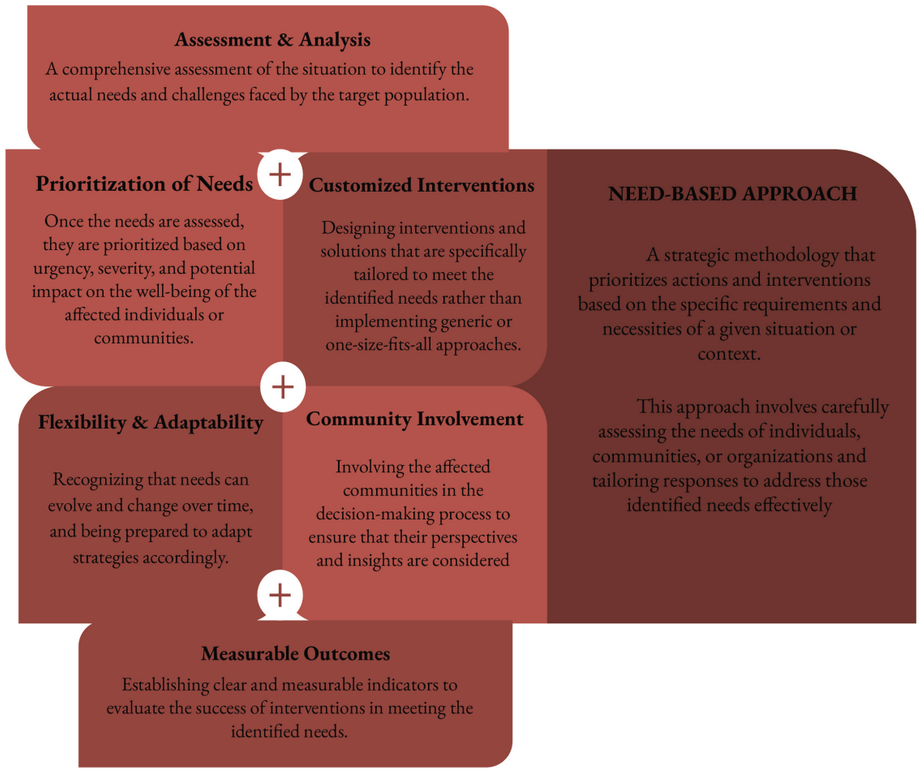
[10] *Traditional notions of unity often refer to a more simplistic or hierarchical approach to collaboration. It implies that all stakeholders are expected to conform to a single vision or plan, with little room for dissent or disagreement. This can lead to a top-down approach, where decisions are made by a few individuals or organizations without significant input from others.*

In contrast, the CTU Framework for SHS emphasizes a more collaborative and inclusive approach. It recognizes that different stakeholders have diverse perspectives and experiences, and that these differences can be valuable in developing effective solutions. By fostering collaboration and shared decision-making, the CTU Framework goes beyond traditional notions of unity to create a more dynamic and effective response to humanitarian crises.

Figure 15-12 *Collaboration Transcends Unity Framework for Sustainable Humanitarian Support - CTU Framework for SHS [Source: KSDMA]*



Fif 15-13 *Need-Based Methodology for CTC framework for SHS*



[Source: Kerala State Disaster Management Authority [2023], അൻബോട് കേരളം - TAMIL NADU FLOOD RELIEF 22.12.2023 – 29.12.2023 Collaboration Transcends Unity, Government of Kerala]

27. Harnessing Local Markets: A Forgotten Casualty of Disasters

The 2024 Meppadi landslide highlighted the importance of supporting local economies during disaster relief and recovery efforts. One significant observation was the disruption of local markets, which often suffer from the influx of external aid and resources.

During disasters, Kerala witnesses an outpouring of humanitarian aid and volunteerism, both domestically and internationally. While this generosity is commendable, it can inadvertently impact local businesses. In the case of the Meppadi landslide, which occurred during the Onam festival season, many local vendors had invested heavily in their businesses, often relying on loans and borrowings. The sudden disruption caused by the disaster severely affected their livelihoods.

To mitigate this issue, future disaster response efforts should also facilitate prioritizing local markets. The purchasing of relief materials from local vendors can help sustain local economies and accelerate recovery. By incorporating strategies to support local businesses into disaster recovery plans, the government can ensure a more equitable and sustainable recovery process.

28. Virtual Cadre for Disaster Management – KSDMA, Govt. of Kerala

To strengthen the disaster management capacity of the stakeholder departments, Government of Kerala vide G.O (Rt) No: 56/2017/DMD; dated November 25, 2017 had initiated Virtual Cadre for disaster management. The goal of the virtual cadre is to mainstream disaster risk reduction into sectoral departments, thereby mitigate the risk of disasters in each sector.

Section 38(2) (g) of the Disaster Management Act, 2005 mandates the preparation of departmental Disaster Management Plans and integrate disaster preparedness and mitigation measures in developmental plans per the NDMA and SDMA guidelines.However, the departments do not have the needed expertise to prepare Disaster Management Plans and Disaster mitigation concerns are not addressed with the developmental plans.

The Virtual Cadre, once fully capacitated, will be able to support the departments in doing the above mentioned tasks. Keeping the above at the forefront, KSDMA had collaborated with UNDP and UNICEF form 2019 onwards in the Capacity Development of Virtual Cadre Officials of Kerala. The primary objective is to build and strengthen the capacity of virtual cadre officials at the state and district level for acting as champions in disaster preparedness and management. For this, twenty six departments of state government have been selected to provide training on different areas specific to their department in the context of any emergency.

The first Virtual Cadre Training program was held in 2018 and Land Revenue Department was chosen as the first department to undergo the trainings. Since then, 26 Departments were selected for the Virtual Cadre Program. In the earlier trainings, 15 officials with 20 years of experience were to be selected from each department across the state for the Virtual Cadre Trainings. But challenges arising from, frequent transfers of officials in departments, impact of COVID 19 lockdown called for changes in the scheme. According to the latest GO (Government Order) (Rt) No. 902/2022/DMD (Dated: 24 December 2022), each department needs to nominate only 7 officials (instead of 15) from their supervisory post who will act as Virtual Cadre Nominees for the next 5 years. The selected VC officials will be incrementally trained on various capacity-building practices such as recovery, response SOP, incident command system etc., specific to their departments.

The Virtual Cadre, once fully functional, will have Disaster Management champions who will be equipped to prepare plans and support their respective departments in mitigating disaster risks. Till date basic level training for all twenty six departments have completed. Advance level training for the preparation of departmental/ sectoral DM plan is the requirement for the future. Government departments are large bodies that work for civil society and involve members who are educated, well informed and specialize in their departments' operations. It is important that these departments remain resilient in times of emergencies to continue their own functions as well as assist the government in maximum capacity in DRR activities for the state.

Therefore, for mainstreaming DRR into department level planning, expert level knowledge on DRR and DM mechanism is necessary for the department. The challenge here is that this large body of working professionals are not fully familiar with disaster management norms and practices and require support and training to perform Disaster management related activities in a formal capacity. Endowing these departments with a ready made DM Plan will be detrimental as it will not confer any transfer of knowledge or understanding and would only be referred to when a disaster has already taken place. Therefore, it is ideal to involve the department's officers in the planning process and train them in technical knowledge in Disaster Management and keep them involved in developing a Departmental DM Plan for their own department.

Objectives of Virtual cadre program

- Enhance the capacity of department in disaster response and DRR activities
- Develop Department specific Disaster Management Plans
- Enhance inter-department co-ordination and collaboration during disasters.
- Link DRR activities with Department's development Plans

Role of Virtual Cadre Officers

The virtual cadre, once fully functional, will support the concerned departments in carrying out the following activities:

- Develop and update departmental disaster management plans.
- Support District Disaster Management Authority (DDMA) in preparation of DDMP.
- Prepare training calendar for district and ensure necessary arrangements for training.
- During emergency, support DDMA and work with the departments.
- During emergencies, inform the directions and decisions taken by the SEC and coordinate with district-level line departments.
- Provide necessary support and advice to the departmental head and ensure that the activities under the departmental plan are not increasing disaster risk.

15.7. Structural Interventions

To mitigate the effects of future landslides and debris flows, similar to the devastating events that occurred in Meppadi Panchayat, a range of structural measures can be implemented.

Slope Stabilization:
Several slopes along the debris flow path have been destabilized by the event and need to be stabilized as recommended in the other sectors of this assessment. Nature-based solutions (NbS) can be crucial in stabilizing slopes along rivers destabilized by debris flow events. Vegetation, particularly deep-rooted plants and trees, can reinforce soil and prevent further erosion. Techniques like bioengineering, which combines vegetation with structural elements like live crib walls and gabions, can provide immediate stabilization and long-term reinforcement as the vegetation grows.

Drainage:
Slope drainage is a critical component of nature-based solutions (NbS) for slope stabilization, particularly in areas affected by landslides and debris flows. Effective drainage systems help manage water runoff and reduce soil saturation, which can destabilize slopes. It is essential to ensure proper drainage of excess rainwater from steeper sections of slopes through lined predefined channels that can help prevent further destabilization.

Debris Flow Mitigation:
For locations with similar landslide debris flow hazards similar to this, where future landslides could trigger debris flows, it is important to create Debris retention basins or check dams to trap and slow down the movement of debris flows. Concrete or earth filled deflection walls may also be planned to guide and divert debris flows along predetermined paths away from vulnerable areas.

Controlled Channels:
Designing and constructing controlled channels to help direct debris flows away from vulnerable areas, minimizing potential damage to infrastructure and communities.

Culverts and Bridges:
Properly designed culverts and bridges can facilitate water flow while preventing debris accumulation, ensuring that waterways remain unobstructed during heavy rainfall. Reconstruction of bridges across the river channel should consider the provision of adequate freeboard to prevent clogging and overtopping. Design the bridge foundations and abutments to resist the high impact forces of debris flows.

Strengthening Infrastructure

Bridge and Road Reinforcement:
Invest in the reinforcement of critical infrastructure, such as bridges and roads, to ensure they can withstand extreme weather events and remain accessible during emergencies. In high and moderate hazard zones, if there is no evacuation route and safe assembly places, it should be constructed based on the land suitability analysis and consultation with local people and local government institutions.

Safe Route Considerations:
The designated safe route should be motorable and equipped with supportive fencing, especially if it traverses hilly terrain. Solar powered lamps should be installed along the route to ensure visibility during emergencies. The local disaster management committees should be responsible for the proper maintenance of these solar lamps and for conducting regular safe route clearing drives.

15.8. General Recommendations

I. Checklist for detailed natural disaster impact assessment approved as Government Circular DMB1/82/2023/DMD dated 18-12-2023 shall be specifically filled and included in every project proposal funded by Government funds that is approved for implementation (https://tinyurl.com/DMCklist) in this area. All Government projects should follow Indian Standard Codes. The Indian Standard Codes may be made available to all departments through the Library of Government Secretariat or Library of Legislative Assembly in digital mode.

The hazard susceptibility linked relocation plan approved vide GO (Ms) No. 6/2019/DMD dated 27-2-2019 needs to be continued and the amount may be increased to INR. 8 lakhs for a mini-mum of 3 cents of land and INR. 8 lakhs for construction of a house of not less than 80 m2.

The houses of those who availed the benefit of INR. 10 lakhs for hazard susceptibility linked re-location under the parent order GO (Ms) No. 7/2018/DMD dated 21-6-2018 and all orders there after linked to this order shall be demolished as it is noted that some owners are utilizing the old houses as Home Stays and residences for rental. This defeats the very purpose of hazard susceptibility linked relocation. No overnight and permanent residence can be permitted in these houses.

II. The technical committee constituted vide GO (Rt) No. 664/2018/DMD dated 30-11-2018 recommended a specific form conducting field examination before permitting building construction in hilly areas. The examination is to be conducted by a joint team of Local Self Government Engineer and District Geologist. This form and inspection shall be included in to the Kerala Municipal/Panchayat Building Rules but amending it appropriately. The proposed form is attached as Annexure 1:15.9 (a).

III. The risk informed master plan to be mandatorily prepared by Urban Local Bodies vide GO (Ms) No. 120/2022/LSGD dated 9-6-2022 shall also be prepared by all Rural Local Bodies such that sustainable land use is ensured.

IV. GO (Ms) No. 156/2019/LSGD dated 4-12-2019 all local governments are supposed to undertake community based risk reduction activities. Working groups have been formed in the local bodies to plan disaster risk reduction activities and supervise the implementation. Vide GO (Ms) No. 84/2022/LSGD dated 19-4-2022 and GO (Ms) No. 86/2022/LSGD dated 19-4-2022 Government, based on the recommendation of the 14th Finance Commission of Local Self Governments have made it mandatory for all local governments to earmark funds for disaster management and undertake risk reduction projects.

It is noticed that local government earmark funds for disaster risk reduction but many projects are seen to be not implemented. In order to tide over this, the working group for disaster management formed vide GO (Ms) No. 156/2019/LSGD dated 4-12-2019 should meet mandatorily every 3 months and ensure that project for disaster risk reduction is implemented.

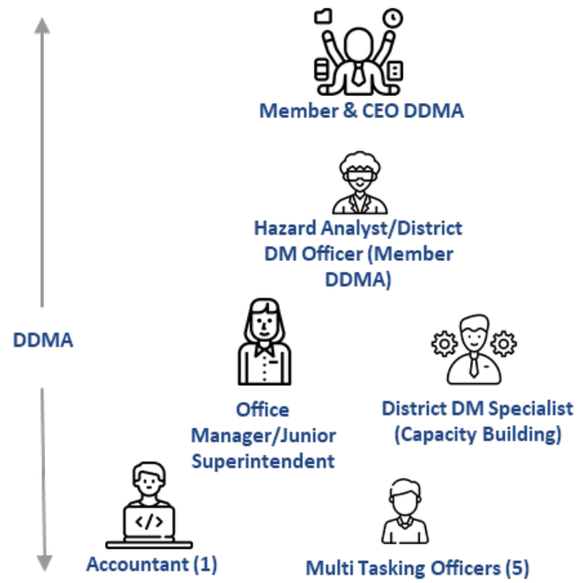
V. Government may consider creating High Altitude Emergency Response Centre (HAERC) under the direct control of Kerala State Disaster Management Authority in Idukki and Wayanad Districts. The HAERCs shall have various hyper local monitoring systems, facility to accommodate not less than 100 individual strong response forces and advanced high-altitude vehicles.

VI. Three more full time expert members in addition to the Member Secretary may added as Member to the Kerala State Disaster Management Authority. Each full-time member shall be given specific domains and districts to mentor and support.

VII. The National Disaster Management Authority is contemplating a national cadre in line with which the office of KSDMA needs to also be aligned. A proposal in these lines is before the Government of Kerala which needs to be considered actively.

VIII. The District Disaster Management Authorities needs to be made independent and infused with at least 3 full time independent expert members. The current structure of DDMA with no expert member does not serve the purpose of disaster risk reduction. Currently, all other members are subjected to routine transfers. The National Disaster Management Authority is contemplating a national cadre in line with which the office of DDMAs of Kerala needs to also be aligned. The DDMAs needs to be a technolegal entity having a healthy mix of professionals leading the decision making process. It is proposed that the current post of District Hazard Analysts may be renamed as District Disaster Management Officers. The District Hazard Analysts/District Disaster Management Officers of the respective districts with 5 years or more of continuous experience as The District Hazard Analysts/District Disaster Management Officers may be made as one of the three expert Members of the DDMA as the only institutional memory in a district on disaster management is through the District Hazard Analyst. The current position of local self-government disaster management plan coordinators shall be renamed as District DM Specialist (Capacity Building).

A structure proposed is given below.



The salary proposed by NDMA may be adopted for the professional cadre.

IX. The DDMA's office needs to be multi-disciplinary and not biased to any cadre. The Chief Executive Officer of DDMA may be a Kerala Administrative Service Officer in the District. The Office Manager may be from Land Revenue Service and the administrative staffing of DDMA at the Multi-Tasking Officer (Clerical) level needs to have representation from Land Revenue and Local Self Government Departments. The accountant may be on contract or directly from the Divisional Accountant Cadre.

X. The Forest Management Plans currently do not have landslide risk reduction projects. 2018 and 2019 landslide inventory indicate that numerous landslides occurred in pristine forests. Therefore, landslide risk reduction works including slope stabilisation works, inspection for identifying potential landslide triggering zones, routine annual debris removal from major hill streams within forest areas, river training and creating deflection walls etc. shall be incorporated into Forest Management Plans.

XI. Hill streams shall not be obstructed by constructing causeways and bridge pillars in the river bed. Only tress bridges or arch bridges that are adequately above the maximum flood level ascertained through ungauged catchment equations as prescribed by appropriate IS Codes shall be permitted in hilly districts. Every stream crossing structure, whether a bridge, culvert, weir, or check dam, shall be structurally designed based on hydrological modelling before administrative sanction is given. Undesigned civil structures shall not be permitted within the river beds.

XII. At least one automatic rain gauge and thermometer may be installed in every ward to improve monitoring of rainfall and heat. At least one automatic weather station needs to be installed in every panchayat. The support of Kerala Start Up Mission to engage start-ups in the project may be actively explored as it will increase local capacities to deploy and manage such environmental sensors. By utilizing these institutions, these private institutions established with government assistance can provide more capacity and employment opportunities and ensure long-term maintenance of equipment.

XIII. The water level in the river and small channels is as important as the weather. Along with rainfall information, to predict the local probability of landslides/regional flash floods, water level in small canals and rivers should also be monitored at local level. Locations for deploying stream gauges by local governments may be prepared jointly by KSDMA, CWRDM and Water Resources Department. Start-ups may be engaged for this activity so as to ensure local support and long-term maintenance of equipment.

XIV. Prepare a list of various vulnerable categories of people who are most likely to be affected by the disaster according to the Orange Book, and mark where they live in the respective local body on a map and post the data on the website of the District Disaster Management Authority and in the website of the local self-government.

XV. Accurate information on currently available geophysical data, especially on topography, land cover, soil variations on the earth's surface, settlements, buildings, roads, and other structures, is required to identify disaster-prone areas (such as landslides, floods, etc.) at a detailed level. A LiDAR survey should be conducted throughout Kerala and high-resolution aerial images should be collected. For this, the services of the National Remote Sensing Agency are required. Government of India may consider subsidising this costly data collection through ISRO.

XVI. Public awareness about the risk of disasters in disaster-prone areas is essential. In the landslides that occurred in Vilangad, Kozhikode, many lives were saved because the people of that area had awareness about landslides. Often, even after receiving a warning, people do not voluntarily evacuate owing to other considerations. Therefore, the local level project 'Nammal Nakmaayai', which was started in 2019, needs to be carried out more intensively in the form of a campaign.

XVII. In the hilly areas, inland areas and coastal areas, more Multi-Purpose Shelters should be established like the temporary rehabilitation centres currently established in 9 coastal districts. These can be established or public/private buildings that are currently available can be converted into temporary rehabilitation centre's quickly can be acquired on rent or on a contractual basis based on long term agreements with the owners.

XVIII. All local bodies should create a local Emergency Response Reserve ahead of every monsoon using the funds made available through the Orange Book (Section 4.101 of Orange Book)

XIX. Nature Based Solutions can be used to protect areas where people live together. Many such models are available in Kerala itself. Panchayats should adopt such models when preparing their Risk Informed Master Plans, wherever possible. KILA has identified many such models and published them in the form of videos and short notes. The services of the State Disaster Management Authority, KILA and CWRDM can be used to adopt these.

XX. In the case of construction and development of public roads especially on hill slopes with a slope of more than 20 degrees, slope cuts shall not be more than 1 meter and preferably ter-raced and packed with geotextile and reinforced with deep rooting grass species. If the slope cut is more than 1 meter in height adequate toe support structure, water draining structure and weeping holes should be designed with the help of engineering colleges and the cost of designing should be included in the administrative sanction. All bare soil road cuts should be covered with coir geotextile and ginger grass or vetiver should be planted and grown and maintenance of these grass for 10 years shall be part of the road construction contract.

XXI. Permission of Local Self Government Secretary shall be made mandatory for constructing roads on private land on slopes with a slope of more than 20 degrees. Before granting permis-sion from the Secretary shall seek the report of a joint inspection of the site by Mining & Geology, Soil Conservation Department, and Local Government Planning Department. Permission should be granted only after their inspection and recommendation are clearly received. If the road is built on a slope of more than 20 degrees permission should be granted only after receiving structural design of necessary toe support structure, water draining structure, weeping holes, and terracing prepared by Structural Engineers/Geotechnical Engineers. All bare soil road cuts should be covered with coir geotextile and ginger grass or vetiver should be planted and grown and maintenance of these grass for 10 years shall be part of the permission given and shall be the responsibility of the owner of the land.

XXII. On hill slopes with a slope of more than 20 degrees, digging holes for agricultural purposes during the rainy season, storing water in such holes, and digging rain pits should not be allowed. It has been noticed that when rubber trees are cut down, the remaining steps and roots are dug up with heavy machines. As such activities affect the soil's moisture content and strength and increase the chances of landslides. It is appropriate for the Agriculture Department to prescribe appropriate agricultural practices in hill areas in consultation with KSDMA and other appropri-ate agencies.

XXIII. Due to climate change, severe floods, which used to occur once in 10 years in the past, are now recurring once in 1 year. Therefore, it may be appropriate that permission is not given for buildings of public use or residences in the 10-year flood susceptibility areas. It is advisable for sustainable development to relocate the existing public/private buildings in such places within the next 10 years.

XXIV. Land use regulations are spread across multiple, inconsistent orders, laws, regulations, and court orders. This creates great constraints for enforcement agencies. Due to the lack of commonality in land use regulations, business and residential areas have overlapped. Therefore, there is a need for separate land management policies, codified laws, and regulations for coastal, inland, and mountainous areas. An expert study is essential for integrating land use related legal instruments. The Terms of Reference for conducting the necessary study for this is attached as Annexure 2: 15.9 (b).

XXV. The Land Use Board should take the initiative in preparing land use plans for coastal, in-land and mountainous areas separately and support the Risk Informed Spatial Master Planning Process of Local Self Governments in adopting appropriate land use. To strictly implement the land use regulations prepared, it is necessary to consider creating a separate division called Land Management in the Land Revenue Department which has experts from geoscience and planning, like in the United States. It is pertinent to note that the mission of the Bureau of

Land Management in the United States is "to sustain the health, diversity, and productivity of public lands for the use and enjoyment of present and future generations".

XXVI. The scope of Aapda Mitra volunteers may be increased by utilizing them as Tourist Guards and Trekking Guides in areas where they are available as they are trained in various life saving techniques. The Tourism Department shall issue instructions in this regard. This possibility of livelihood will attract more youngsters to join as Aapda Mitra Volunteers or Civil Defence Vol-unteers and thereby increase the number of first responders locally.

Table 15-3: *Budget*

	Approx. unit. Cost	Unit	Total
STRUCTURAL MEASURES			
1. IRRIGATION			
River training to reduce risk			
Cost of silt removal of 3,00,000 cum of silt	215.37	3,00,000 cum	6.46
Cost of removal of 4,50,000 cum of rubble	1203.69	4,50,000 cum	54.2
Cost of Gabion side protection works of height 6m	123000	10000m	123
GST @ 18% and unforeseen items			33.34
Sub Total			**217**
Geo-textiling of river flanks	Will be Worked out by Concerned Section		
Widening and deepening of river coarse/Periodic maintenance of the stream			
Hydrodynamics study of river coarse (non-structural intervention)			
2. ROADS AND BRIDGES			
Disaster resilient roads and bridges based on vulnerability assessment and history of extreme events with associated infrastructure for resilience such as check dams and debris arresters	Will be Worked out by Concerned Section		
3. HOUSING AND PUBLIC BUILDINGS			
Disaster resilient structures based on vulnerability and history of extreme events	Will be Worked out by Concerned Section		
Confined Masonry			

Housing facilitation Centre + Capacity Building			
Integration of all aligned sectors in implementation			
4. SHELTER			
Disaster resilient structures based on vulnerability and history of extreme events	Will be Worked out by Concerned Section		
Safe Site Selection and Accessibility			
Identification of Temporary shelters at microlevel			
Providing sufficient amenities at shelter camps			
5. POWER AND LIGHTING SOLUTIONS			
Emergency Power Supplies for rescue workers in kit	600	100	0.006
Installation of Solar-Powered Lighting (INR 30000 per pole for every 20 m for 20 km)	30000	1000	3
6. STRENGTHENING CAPACITIES AND RESOURCES			
Need for 3 New Fire Stations and Specialized Equipment			
Increasing Staff Strength and Space Expansion	60000000	3	18
Health and Risk Insurance for Rescue Personnel and Protection of Personal Belongings (INR 5000/year) for 5 years	25000	60	0.15
Locker Facilities at Local and Regional Levels	300000	3	0.09
Digitalization of Documents for Vulnerable Communities	2500000	3	0.75

NON-STRUCTURAL MEASURES			
	Approx.unit.Cost	**Unit**	**Total**
1. ENHANCING COMMUNITY ENGAGEMENT AND AWARENESS			
Community Education Programs	100000	30	0.30
Building and Training a Volunteer Network	200000	60	1.20
Aapda Mitra & Civil Defence Expansion	30000	100	0.30
Establishing Community Disaster Response Committee and training	1000000	3	0.30
Identification and training for Community Influencers (10 per ward for 3 years, 2 batches per year)	2500	60	0.015
2 . EARLY WARNING SYSTEM AND MONITORING MECHANISM			
AWS in three wards	60000	3	0.018
Strain sensors in rivers where susceptibility is high	Worked out in irrigation		
Community-based manual rain gauges	25000	30	0.075
Cameras for monitoring flood levels	80000	6	0.048
Run out models with scenarios	2500000	1	0.25
Watershed-based Risk Assessment and mapping study	1250000	1	0.125
Environmental Sensor Network for monitoring AQI, WQ and soil moisture	30000000	1	3
3. INFORMATION DISSEMINATION/RISK COMMUNICATION			
Community influencers/Community-based DRR Measures capacity building (3 years* 2000 people, yearly trainings)	2500	6000	1.50
Community engagement and capacity building in risk monitoring (3 years* 200 people per ward, yearly trainings)	2500	600	0.15

4. EMERGENCY RESPONSE PLANNING AND PREPAREDNESS			
Mock drills with community engagement in highly susceptible areas (3 years* 2 times a year, for 3 wards)	200000	18	0.36
Assessment of Needs and inventory planning	500000	3	0.15
Stockpiling of Supplies			
Inventory Tracking and Management Systems			
Rotation and Expiry Management			
5. CAPACITY BUILDING AND AWARENESS			
Awareness on Climate change Adaptation strategies (3 years, yearly 3 trainings, 22 wards, 3 batch per year)	125000	396	4.95
Risk insurance (INR 200000 for 5 years*total number of HH effected)	100000	2007	20.07
Total Reconstruction and Recovery Cost Estimate			**271.81**

Table 15-4: *Cross Cutting Areas and Responsible Agencies*

Category	Activities	Agencies
IRRIGATION	River training to reduce risk	PWD, Geology, Irrigation
	Geo-textiling of river flanks	Irrigation, LSGD, MGNREGS
	Stream protection/Bank stabilization measures/ retaining walls	Irrigation, MGNREGS, LSGD
	Removal or management of boulders, trees and debris	LSGD, Irrigation
	Widening and deepening of river coarse/ Periodic maintenance of the stream	Irrigation
	Hydrodynamics study of river coarse – non-structural intervention	
ROADS & BRIDGES	Disaster resilient roads and bridges based on vulnerability assessment and history of extreme events with associated infrastructure for resilience such as check dams and debris arresters.	PWD, Forest, LSGD and Irrigation
HOUSING & PUBLIC BUILDING	Disaster resilient structures based on vulnerability and history of extreme events. Confined Masonry Housing facilitation Centre + Capacity Building Integration of all aligned sectors in implementation Priority to: Women head houses, disabled persons, tribes, vulnerable group Resources Mapping, Monitoring for reduced carbon footprint generation	Concerned Departments
SHELTER	Disaster resilient structures based on vulnerability and history of extreme events. Safe Site Selection and Accessibility: Identification of shelter location based on existing vulnerabilities Identification of Temporary shelters at microlevel based on the type of disaster Providing sufficient amenities at shelter camps	LSGD, PWD

EMERGENCY RESPONSE PLANNING & PREPAREDNESS	Assessment of Needs and inventory planning	LSGI/ DDMA
	Stockpiling of Supplies	LSGI, Fire and rescue
	Inventory Tracking and Management Systems	LSGI, Fire and rescue
	Rotation and Expiry Management	LSGI, Fire and rescue
CAPACITY BUILDING & AWARENESS		KSDMA, DHS, LSGD, Forest
CLIMATE CHANGE ADAPTATION STRATEGIES	Local strategic action plan on climate change adaptation	LSGI
RISK INSURANCE	Disaster Risk Finance	Agriculture department, Animal Husbandry Department, KSDMA, Health Department
AGRICULTURE	Low carbon farming	Agriculture department
	Climate smart agriculture practices	Agriculture department
	Zero tillage/ conservation agriculture promotion/ no rain pits zone/ deep rooted systems	Agriculture department, MGNREGS
	Income diversification activities such as intercropping, multi cropping, integrated farming	Agriculture department
	Soil health cards	Agriculture department, LSGI
	Sustainable soil and water management	Agriculture department, Soil and water conservation
	Insurance and Risk Transfer	Agriculture department
	Farmers' collectives and marketing initiatives	Agriculture department
	Post-harvest storage facilities	PWD, Agriculture department
	Risk Awareness among agricultural labourers	LSGD, Agriculture department, KSDMA

PUBLIC HEALTH	Hospital DM plan at all levels	KSDMA
	DRR awareness training, for all healthcare workers including AW workers, Asha workers	LSGD
	Mock drills	KSDMA, Health department
	Health monitoring mechanism	Health department
	Assessment and mapping	KSDMA, LSGI, Health department
	Fencing for township	PWD, LSGD, Town Planning
	Water quality management system	KWA
ANIMAL HUSBANDRY	Animal shelters	None addressed
FOREST	Seed broadcasting	Forest department
	Raising Nursery	Forest department
	Afforestation	Forest department
	River bank stabilization using NbS	Forest department
	High range AWS station monitored by forest department	Forest department, Geology, KSDMA
	Interventions to reduce wildlife conflict	Forest department
PUBLIC HEALTH	Hospital DM plan at all levels	KSDMA
	DRR awareness training, for all healthcare workers including AW workers, Asha workers	LSGD
	Mock drills	KSDMA, Health department
	Health monitoring mechanism	Health department
	Assessment and mapping	KSDMA, LSGI, Health department
	Fencing for township	PWD, LSGD, Town Planning
	Water quality management system	KWA
ANIMAL HUSBANDRY	Animal shelters	Concerned Department

FOREST	Seed broadcasting	Forest department
	Raising Nursery	Forest department
	Afforestation	Forest department
	River bank stabilization using NbS	Forest department
	High range AWS station monitored by forest department	Forest department, Geology, KSDMA
	Interventions to reduce wildlife conflict	Forest department
VULNERABLE COMMUNITIES		
TRIBES	Content based Inclusive tribal DM plan with involvement of tribal Climate warriors	LSGI, Tribal Department, Tribal Communities, DDMA, KSDMA
	Save evacuation procedure and shelter facilities for tribes	
	DM training for Communities	
	Unnathi based HVRA	
	Inclusive early warning- in local language	
	Documentation of tribal knowledge related to DRM and climate change	
	Inclusive and participatory Evacuation route planning	
MIGRANT WORKERS	HVRA of Migrant hotspots	KSDMA, Labour Department
	Management of migrant database and registration system	Labour Department
	Developing Multilingual and infographic early warning system	KSDMA
	DRR awareness and training for Link workers	KSDMA, LSGI
	Insurance for migrant workers	Concerned Department
	Inclusion of migrant communities in LSGD DM plans	KSDMA, LSGI
	Inclusive mock drill on Disaster response- Multilingual	KSDMA
	Livelihood interventions backed by risk insurance	Concerned Department
	Body repatriation mechanism for migrants	Concerned Department

PLANTATION WORKERS	Vulnerability assessment of plantation workers and households	Community, KSDMA and LSGI
DIFFERENTLY ABLED	Risk assessment of Differently abled and need assessment	SJD and LSGI
	Dissemination of Early warning messages to differently abled	SJD and LSGI
	Disability inclusive DRR	KSDMA, SJD and LSGI
	Save evacuation procedure and	SJD and LSGI
	Shelter facilities for disabled and relief services	Social Justice Department and LSGI
CHILDREN	Education, Scholarship, Sponsorship	LSGI, SJD, WCD
TRANSGENDER	Livelihood interventions backed by risk insurance	Social Justice Department, LSDI
WOMEN	Livelihood interventions backed by risk insurance	Social Justice Department, LSGI, WCD
ELDERLY	Livelihood interventions backed by risk insurance	Social Justice Department

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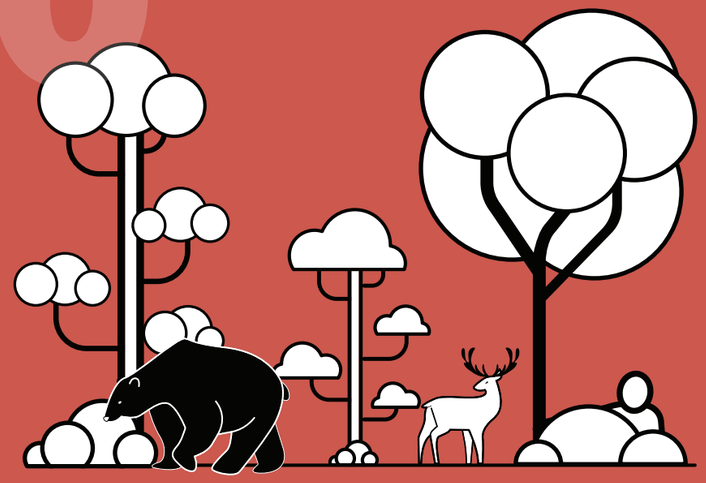


Forest and Environment

16.1. An Overview

Wayanad district, spanning 2,130 square kilometers, is predominantly forested, with 40% of its area covered by lush green vegetation. It shares borders with the Indian states of Karnataka and Tamil Nadu, as well as the Kerala districts of Malappuram, Kozhikode, and Kannur (north by Coorg, east by Mysuru and Chamarajanagar districts of Karnataka, on the southeast by Nilgiri district of Tamil Nadu, on the south by Malappuram and on the west by Kozhikode and Kannur districts of Kerala).

The Western Ghats' orographic effect creates a distinct rainfall gradient across the district, with the western regions receiving significantly higher rainfall (2000-5000 mm annually) compared to the eastern regions (1200-1500 mm annually). This topographic and climatic diversity has led to a rich variety of ecosystems, supporting numerous globally significant flora and fauna species. Wayanad plays a crucial role in the hydrological cycle, serving as the primary watershed for the Kabini River, a major tributary of the Cauvery River. It is also the origin of the Chaliyar River, the fourth longest river in Kerala. The Wayanad Plateau is considered an extension of the Mysore Plateau, which forms the southern end of the Deccan Plateau.

'Vellarimala' hill ranges which is at the tri-junction of three districts namely Kozhikode, Wayanad and Malappuram adjacent to Vavul mala (2339m) is a high altitude landscape christened by the British as "Camel Hump moun-

tains". William Logan, a civil service servant who served as Malabar collector described these mountains in his book Malabar Manual as 'a most conspicuous landmark from all points on the coast and from far out at sea, covered to the very top with virgin forest'.

The landscape is dominated by various vegetation including farmland, plantation, forest cover and water resources. The plantation areas are dominated by tea, coffee, cardamom, pepper and the low-lying drainage laden valleys are dominated by paddy, banana, ginger and turmeric plants. Thus, the livelihood of the people is networked strongly with the environs which also provides emerging commercial-economic opportunities such as tourism. Various forms of tourism such as adventure, monsoon, homestay, trekking, eco etc are prominent here heavily relying on the terrain, landscape and climate.

Effect of Landslide on the Environment

Landslides are destructive agents which change and modify the landscape or disturbs it. Destruction or disturbance is costly for the built environment and also for natural resources, and yet it is essential for ecosystem cycling in the natural environment.

Forest destruction:
The destruction of trees and vegetation during the landslide results in deforestation in the affected area. Trees and plants play a crucial role in stabilizing slopes, reducing erosion, and maintaining the health of ecosystems. Deforestation can have long-lasting effects on biodiversity, as it can lead to the loss of habitat for plant and animal species, disruption of ecological processes, and reduced resilience to environmental changes.

Habitat destruction:
Landslides destroyed the natural habitats for a variety of plant and animal species. The loss of vegetation cover and the alteration of the landscape disrupt the ecosystems, fragment habitats, and displace wildlife. Species that depend on specific habitats for survival, such as nesting sites, food sources, or shelter, may struggle to find suitable alternatives in the aftermath of a landslide. Habitat destruction can result in declines in biodiversity, loss of rare or endemic species, and disruptions to ecological processes such as pollination and seed dispersal.

Soil erosion:
Landslides often remove the vegetation cover that helps stabilize soil and prevent erosion. The movement of debris and sediment downhill during a landslide strip away the topsoil, which is rich in nutrients and essential for plant growth. This erosion can degrade the quality of the soil, reduce its ability to support vegetation, and lead to increased sedimentation in nearby water bodies. Soil erosion can also contribute to land degradation and the loss of productive agricultural land in the affected area.

Changes in landscape and geomorphology:
Landslides reshaped the terrain and alter the natural features of the landscape. The movement of soil, rock, and debris during a landslide can create new landforms, such as scarps, terraces, or mounds, while also destroying existing land features. The geomorphological changes caused by landslides can have long-lasting effects on the landscape, altering drainage patterns, sediment transport, and slope stability. These changes can influence the distribution of vegetation, the flow of water, and the overall appearance of the environment in the affected area.

Disruption of ecosystem services:
Ecosystem services are the benefits that humans and wildlife derive from healthy and functioning ecosystems. Landslides can disrupt the flow of ecosystem services by damaging or destroying natural habitats, altering water and nutrient cycles, and reducing the ability of ecosystems to provide essential functions. The disruption of ecosystem services can have cascading effects on human wellbeing, as it can impact food production, water quality, climate regulation, and natural mitigation.

Contamination of water sources:
Landslides will mobilize sediment, debris, and pollutants, which can contaminate nearby water sources such as rivers, streams, and lakes. The introduction of sediment and pollutants into water bodies can degrade water quality, impact aquatic ecosystems, and pose risks to human health. Sedimentation can smother aquatic habitats, reducing biodiversity and disrupting the food chain. Pollutants carried by landslides, such as chemicals, heavy metals, and pesticides, can have harmful effects on water quality and the health of aquatic organisms.

Economic and social impacts:
Environment also determines the social and economic capacities and capabilities of the human population of the landscape through various limiting factors and variables. The provisions and services such as water resources, agriculture, tourism, aesthetic value of the ecosystem, local climate regulation, fodder etc. delivered directly or indirectly by the landscape can determine the social and economic boundaries of the human population residing. The landslide affects these provisions of the population and disrupts their wellbeing. Thus, there is a continuum between the socioeconomic costs of landslides and the environmental costs of landslides. This is because a healthy environment is important for sustaining human populations.

Increased susceptibility to future landslides:
The occurrence of a landslide can weaken the stability of the slope and predispose the area to future landslide events. The removal of vegetation cover, disruption of soil structure, and alteration of slope angles caused by a landslide can all increase the likelihood of subsequent landslides in the same area. Factors such as heavy rainfall, seismic activity, and human activities can further exacerbate the risk of landslides in areas that have experienced previous events. Addressing the underlying causes of landslides, such as land use practices, slope management, and drainage systems, is crucial to reducing the vulnerability of landscapes to future landslide hazards.

Restoring and rehabilitating ecosystems after a landslide event is essential to maintain the resilience of ecosystems and ensure the continued provision of ecosystem services to support human livelihoods and biodiversity conservation.

16.2. Basic Profile of the Forest and the Streams

The forest area of the landslide affected crown is a vested forest in an administrative sense derived from the Nilambur Kovilakam during the early 70's. The total area of the vested forest is 2200 ha which comprises of 120 ha of Eucalyptus planatation vested from Harrisons Malayalam Plantation Limited. On the left-hand side of the hillock, there is a cardamom plantation privately owned. The crown of the landslide is punchirimattom near to Vellolippara. Several first order and second order streams drain into the Punnappuzha. This area was affected by a small landslide during 2020 and when the present landslide occurred, all the debris and boulders from the preceding landslide also came tumbling down.

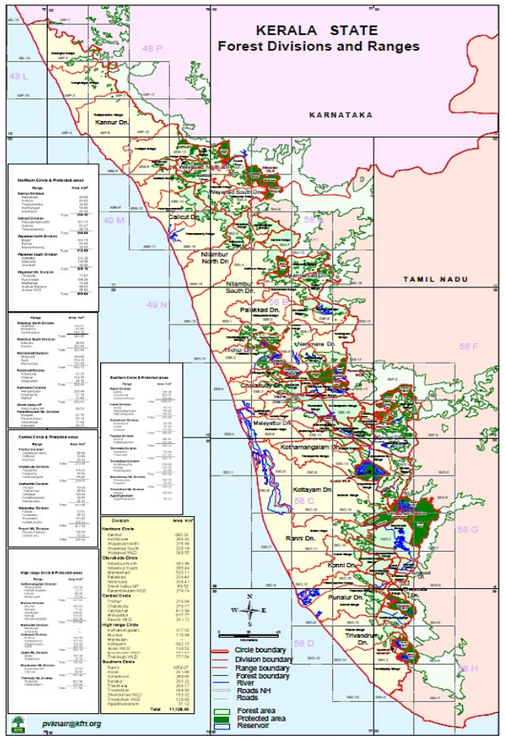
The river depth and width has increased after the present landslide. In many places deep gorges have formed and a waterfall by the name Seethammakund which existed in the vicinity of Mundakkai has been completely obliterated. The forest area end till 'Punchirimattom' the first settlement on the down course of Punnappuzha and five heactares of Forest near the Mundakkai LP school and in the downstream after the Chooralmala new village area. Forest area is home to Asian elephants, sambar deers, leopards and if one is lucky Royal Bengal Tiger can also be sighted. The forest department has a definite working plan in this area.

Vegetation and the Forest type of the area is west coast tropical evergreen forest and the tree species comproses of evergreen species like Palaquium ellipticum (Choppala), Myristica beddomei (Kaattujathi), Colophyllum polyanthum (Kattupunna), Calophyllum inophyllum (Punna), Melicope lunu-ankenda (Kambili). The names 'punnapuzha', 'chooralmala' signify the dominance of reeds - Ochlandra sps and Punna vegetation in this region. Reed colonization plays a significant physical, chemical and biological role on the soil.

The reed patches of Ochlandra species are considered a stable vegetation climax capable of improving the physical properties of the soil and thereby stabilizing slopes and preventing land degradation.The biological activity of the fibrous root system of Ochlandra species with the microorganisms in the top layers of soil strata results in the formation of water stable macroaggregates. Most of the Ochlandra species are riparian in origin as the river banks provide diffuse sunlight and moist fertile soil for healthy reed growth thus these are appropriate species for river bank stabilisation.

Ochlandra species resist uprooting in winds and form population climaxes. Reed bamboos possess a large mass of foliage, culms and dry

Figure 16-1: *Forest divisions and ranges in Kerala*



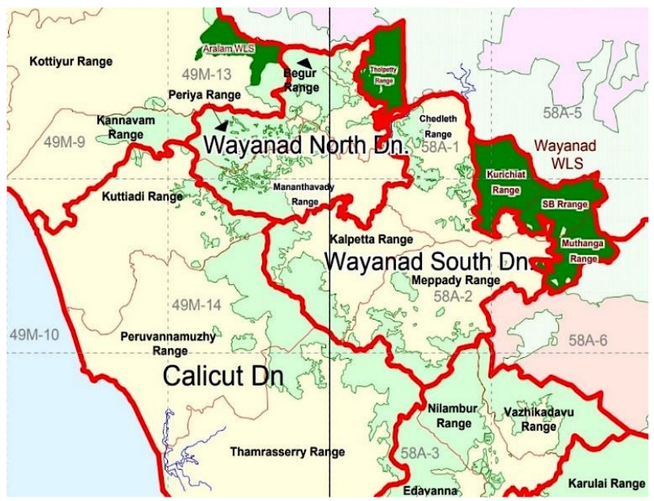


Figure 16-2: *Forest divisions and ranges in Wayanad*

stalks which add large quantities of organic matter to the soil and help in the refinement of soil fertility, both physical and chemical aspects, through nutrient cycling. The soil in reed growing areas is rich in carbon content and replenishing nutrient characteristics by growing reeds has been suggested to improve the soil fertility in degraded soil.

16.3. River and Drainage system

The landslide area widely belongs to Chaliyar river sub watershed in Wayanad District which comprises 15008 Hectare. The main drain starts from Elambalai hills and on its course it joins with Meenakshi puzha, flows in the name of Meenmutty Puzha further joins Kalladipuzha and Mundakkai puzha (Punnappuzha as in toposheet) which then merges to Meenmutty puzha again joins at the boundary with Arunipuzha and flows further in the name of Chalippuzha,which after joining with Choladippuzha further flows in the name of Chaliyar river to Malappuram District.

The disaster (landslide) occurred in the watershed Mundakkai puzha (Punnappuzha) which originates from Vellarimala having an elevation of 2240 and 1983 meter from MSL along the ridges. This area is already prone to landslides, having high drainage density and vulnerable steep slopes.The relief up to Chooralmala is about 1183 m. The Mundakkai puzha belongs to chooralmala micro watershed comprising an area of 1830, Ha.

16.4. Damage and Loss of Forest

In the upper reaches of the Punnappuzha wherein the crown of the landslide is there, forest area to the tune of approx. 19 ha has been completely washed off whereas in the lower reach below Mundakkai, an area of 5.16 ha of forest has been completely wiped away. Further down the chooralmala new village office area forest loss has been accounted till Soochippara waterfalls. So, the total forest area affected by the landslide is 80 ha. The forest type in the upper reaches is west coast tropical evergreen forest and the forest area is part of the vested forest Item No.22 in Resurvey No. 260 of Vellarimala village in Vythiri taluk under Mundakkai forest station of Meppadi Forest Range.

The boundaries of the vested forests are as follows. North – Private land under Harrisons Malayalam Ltd. Tea plantation and otherwise, South – Vested Forest in Kozhikode and Malappuram Dist., East – Vested Forest in Malappuram District and Ranimala private land in Wayanad District, West - Thollayiram Ecologically Fragile Land (Forest) and vested forest under Kozhikode district.

After the recent landslide, the elephant corridor between Malappuram District and Wayanad district has been severely disrupted. This may severely affect the movement of elephants and other fauna through this area and may severely escalate the Human–wildlife conflict in the subsequent seasons.

Name of scheme	Area (Ha)	Status	Remarks
Edakkal Watershed – RIDF X	380	Completed (March 2010)	All Watersheds are now stable, and stabilization works are Successful
Kottoor Watershed – RIDF XV	2420	Completed (March 2010)	
Choladipuzha Watershed – RIDF XV	1870	Completed (March 2015)	
Arunamala Landslide stabilization Scheme	66.96	Completed (March 2016)	
Kadoor Watershed- RIDF XXV	750	On going	

Table 16-1: *Watershed / Landslide stabilization Schemes implemented / ongoing in the Chaliyar sub watershed*

***Table 16-2**: Estimates of Forest loss*

Sl. No.	Location	Forest area Loss Estimate	As per net present value/ha*	Total Loss
1	Landslide Crown area	19 ha	INR1595790/-	INR 3 crores
2	Forest plot at Mundakkai – DPEP bit	5.16 ha	INR1595790/-	INR 0.83 crores
3	Other forest area including the banks of the river	55.84 ha	INR1595790/-	INR 8.94 crores
4	Total forest Loss	80 ha		INR12.77 crores

*Forest diversion _ NPV - 248973538$Rate of Revision of NPV dated 06th Jan 2022.pdf (forestsclearance.nic.in)

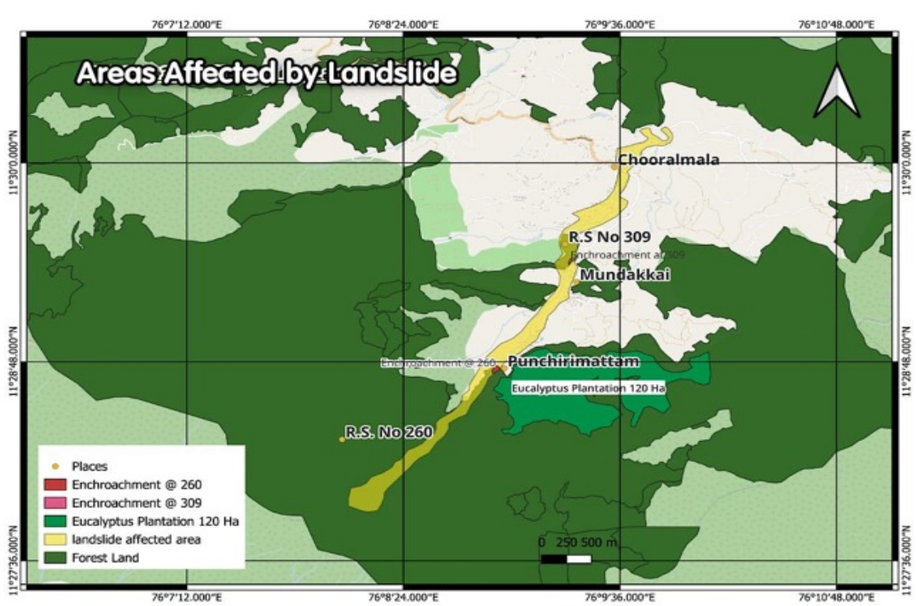


***Figure 16-3:** Forest areas affected by Landslide*

Soil Inventory of the Landslide Affected Area

Soil identified in the area of incidence comes under Meppadi series (in the forest area- crown portion), Meenangadi, Palvelicham Manathavady and Ambalavayal series (present in side slopes) in uplands and Puthurvayal series (present in valleys). The uplands soils are very deep with clayey texture. The presence of boulders and stones in the soil profile is a common feature in this area. The forest area where the landslide originated, are with very steep side slope which contributes to high chances of erosion. The Meppadi series which is seen in the crown portion has very deep soils with weathered boulders and stones throughout the profile and has moderately fine to fine textured soils which are prone to severe erosion.

These soils are sandy clay to clay in texture, having increase in clay content (up to 50%) in the lower layers. The sand content decreases and clay content increases down the profile. The average sand content in the surface layers is 40-55% which helps in infiltration of water, and easy penetration down the soil profile. In the middle and lower layers of the soil profile the average clay content is 50 to 60%. The macro and micro pores contributed water storage down the profile. Meppadi soils (the soils of the crown area) are seen on very steep side slopes. In steep slopes, the mass of the possible moving material under gravity will be more as compared to a moderate slope.

So, the steep slope will be more vulnerable compared to other areas for landslides. The very deep nature of soils, high clay content and presence of numerous fine pores contributes to high water holding capacity, leading to saturation during high intensity rainfall. Stones, cobbles ad boulders which are present throughout the profile contributing to loose and slippery packing of wet soil aggregates which get dislocated easily when the soil is highly saturated in the very heavy rainfall occurred in that area and this might have led to the heavy slip of the land in this area.The side slopes of hills along the first 2 km from the crown point, are very steep with slope ranging from 50 to 70%, then the average slope along 1 km of the area diminishes to 15-20% near Punchirimattom, again the slope rises at Mundakkai up to 40% and finally drops to 5-10% at the deposition area.



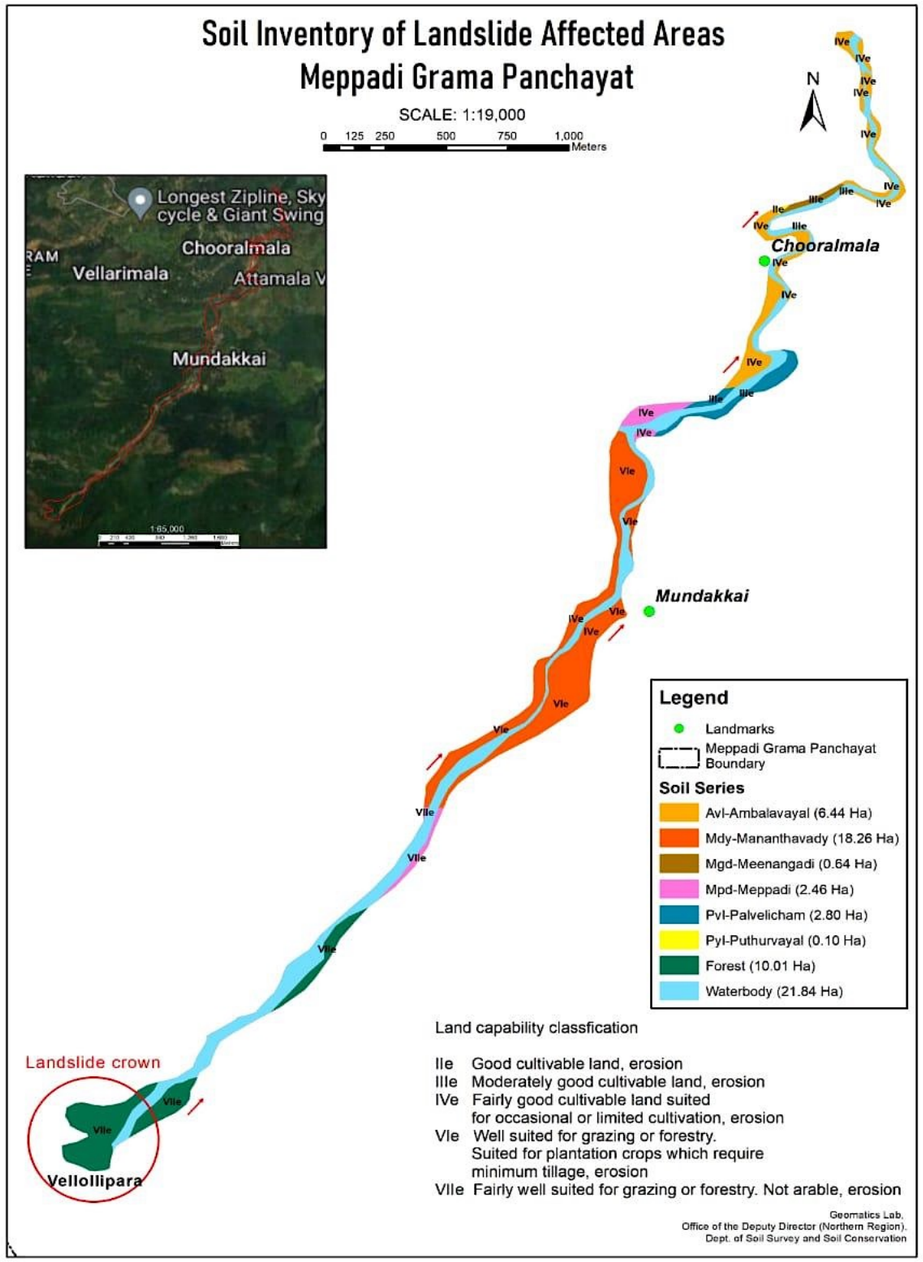


Figure 16-4: *Soil Inventory of Landslide Affected areas*

Table 16-3: *Estimates of Soil loss*

The approximate top soil loss	2.946 lakh tonnes
Total soil loss	37.44 lakh tonnes
Average depth of soil loss	3m (0.5 to 5.5m)

Area Affected by Landslide

Total area affected by land slide assessed approximately is 1.04 km2 or 104 Ha. And the soil loss is estimated as per the available information from the field and the field survey done by the department. The associated cost estimates are not computed since there is no available estimate encompassing the value of ecosystem services.

16.5. Immediate Response Activities

Forest Department

As soon as the first landslide occurred in the early hours 30-07-24, a Forest Patrol team from the Mundakkai Forest Station who were engaged in driving away wild elephants that had transgressed into the human habitations in and around Chooralmala reached the backside of the school building situated in Chooralmala and under the beam lights of the department vehicle rescued 45 people who were stranded in the deep muck caused by the landslide. They could also recover 5 dead bodies from the spot. So in a sense the Forest Department staff under Mundakkai forest station in Meppadi Forest range were the primary responders who risked their lives and limbs in saving the lives of the residents affected by the severe disaster.

Later on, during the day hours of the same day, they assisted the army and NDRF in rescuing survivors who were stuck neck deep in the debris caused by the landslide. The forest department personnel used the zipline temporarily constructed by the army to cross over to the other side of the stream and could provide provisions to the people stranded on the other side of the bank. More over the forest department staff conducted a daring operation to the Erattukund tribal nagar to successfully rehabilitate 24 Paniya tribes who were way laid owing to the landslide. They could also rescue a tribal person hailing from Erattukund tribal nagar and his three children aged 1, 2 and 3 from a rock cave and rehabilitated successfully. Provisions were also supplied to the stranded tribal community members in the Erattukund tribal colony with the help of forest officials.

Further the Forest Personnel were deployed equally in the search teams of the Army, Territorial army, NDRF, Navy, Coast Guard, Special operations group of Police, Fire force as they are well versed with the topography and geography of the terrain. The forest staff were also deployed in the incident command control center set up under the leadership of the incident commander that is IG, Northern Zone. The forest deprtment staff also conducted search operations from the Nilambur side that is upstream of the Chaliyar river and thereby ensuring that both upstream and downstream both sides of the bank were thoroughly searched for dead bodies/body parts.

Even though they were not trained perse in induction and de-induction vis-à-vis helicopter search operations, it was carried out perfectly and efficiently as they knew the forest environs even during sorties. They were later engaged along with the civil defence volunteers in conducting the search for body/body parts downstream of the soochippara waterfalls.





Figure 16-5: *Forest Range Officer providing succour to Erattukundu Paniya Nagar residents who are stranded during the landslide.*





Figure 16-6: *(left) DFO Wayanad South with the Forest Minister in the Disaster affected area on 31-07-24 and (right)Chief minister congratulating the Forest Department officials who rescued Paniya family*

Soil Survey Department

Land Capability Classification

As continuing activity after the soil inventory of the region, the land capability classification was done as part of the field studies. The Land Capability Classification (LCC) System is a global land evaluation ranking that groups soils based on their potential for agricultural and other uses. LCC can help determine if land is suitable for certain uses and whether there are risks for degradation. LCC is composed of two parts: the class and the subclass. The class determines the land's current best use. The subclasses indicate which soil indicators are limiting factors.

The land capability classes identified in the landslide affected area are IIIe, IVe, VIe, VIIe in upland and lie in valleys and lower slopes. Class I to IV lands are arable lands and Class VI and VIII are non-arable lands. The crown area comes under land capability class VIIe. In lands coming class VIIe lands are non-arable, fairly well suited for grazing or forestry. In this type of lands, no other activities can be taken up. The class VI lands seen in the affected area are well suited to grazing or forestry.

These lands can be suitable only for plantation crops which require minimum tillage. Lands coming under VIe have severe limitations that make them unsuitable for regular cultivation, thereby limiting their use largely to graze lands or forestry. Soil erosion hazards due to destruction of natural vegetation, unscientific cultivation practices and other anthropogenic activities are common in these lands.

Other Immediate Response activities

- Staff were involved in the rescue operations with the DDMA team
- Government has appointed a high-level team in order to delineate safe zones along landslide affected area. District Soil conservation Officer was part of this expert committee. The committee is mandated to determine the No-go zone and other zones of activity and; the report will; be submitted; to the Govt.



THE HINDU
Kerala

Five-member panel begins 3-day visit of landslides-hit Chooralmala to assess safety

Panel to demarcate area where people can go in the coming days. It hopes to complete the mission and submit report to government in 10 days after discussions with team members

The Hindu Bureau
CHOORALMALA (WAYANAD)

A five-member expert committee led by John Mathai, former scientist, National Centre for Earth Science Studies, began its visit at the landslides-hit Chooralmala in Wayanad on Tuesday to assess the safety of the site.

Speaking to *The Hindu*, Mr. Mathai said though they started explorations at the crown of the landslide at Puchirimattom, under the Meppadi forest range of the South Wayanad forest division, they could not complete the mission owing to heavy rain from 2.30 p.m.

Five hectares destroyed

Forest department sources reported that more than five hectares of vested forest land on the Vellarimala hills of the Camel Hump Mountain complex had been devastated in the catastrophe. "We just went to the area and had a look at where the materials had come down, widening of the Punnapuzha rivulet, a tributary of the Chaliyar river, and bank erosion. However, we were not permitted to stay there owing to the heavy rain," Mr. Mathai said.

"We arrived here to study the landslide phenomena, including the causes and the exact location," he said.

"A lot of land has been lost on either bank of the stream," Mr. Mathai said adding that they had been directed to make an assessment of the buildings on the banks to ascertain which were stable and unstable.

"We have to demarcate the area where people can go in the coming days. We hope to complete the mission in three days and submit a report to the government in 10 days after discussions with team members," he said.

Collected soil

The team collected soil and pebbles in the area for further studies. The team will resume its operations on Wednesday morning. After the inspection, the team will submit its report to the government, including recommendations for suitable land use in the area.

The team includes T.K. Drishya, Principal Scientist and chief of the Centre of Excellence for Water Related Disaster Management in Kerala; Sreevatsa Kolathayar , Associate Professor, NIT, Surathal; Thara Manoharan, district soil conservation officer; and G.S. Pradeep, hazard and risk analyst, Kerala State Disaster Management Authority.

A five-member expert committee led by John Mathai, former scientist, National Centre for Earth Science Studies, at Chooralmala on Tuesday. SPECIAL ARRANGEMENT

Figure 16-7: *News on the expert team visit to Landslide site to assess the safety concerns in which District Soil conservation officer was a member*

16.6. Post Disaster - Waste Management Activities - In A Nutshell

Waste Management and Environmental Health

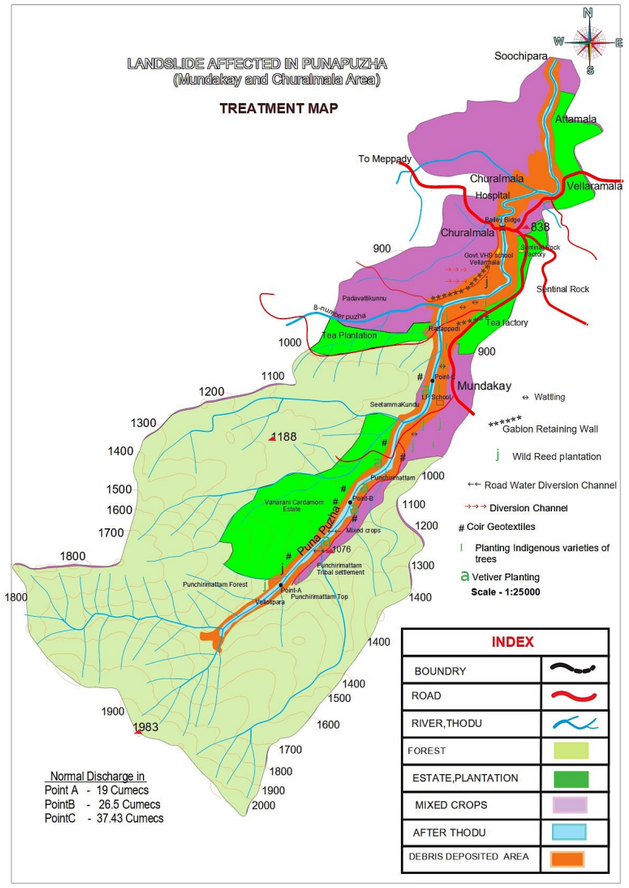
Proper waste management was another critical component of the disaster response, as it directly impacted the health and hygiene of the relief camps.

The relief camps implemented a meticulous waste management system to segregate biodegradable and non-biodegradable waste. This segregation was crucial to prevent environmental contamination and to manage waste efficiently in a constrained environment. Biodegradable waste, such as food scraps, was collected separately and handed over to pig farmers, providing a sustainable method of disposal. Non-biodegradable waste, on the other hand, was managed by the Haritha Karma Sena, who ensured that these materials were disposed of properly or recycled where possible. This careful waste management strategy helped keep the camp premises clean and minimized the risk of disease outbreaks associated with poor waste disposal practices.

Category	Activities Undertaken
BIODEGRADABLE WASTE	• Collected 21.89 tonnes • Collected waste treated in Windrow compost plant at Kalpetta Municipality • 38 bins were provided • 2 vehicles used for transportation • 50 Haritha Karma sena members were employed • New compost plant of 100 kg capacity provided in the landslide
NON-BIODEGRADABLE WASTE	• Total waste collected – 121 tonnes • Average collection – 6.2 tonne • Disposed by Clean Kerala Mission and Green Worms • 4 mini MCF provided • 60 HKS engaged • 74 bins provided • 3 vehicles
SEPTAGE	• Total 173.6 Kl collected • Average – 14.47 Kl generated • 48 bio toilets provided in the affected area and camps • Collected septage treated at FSTP of Kalpetta municipality • 2 mobile septage treatment plant • 6 workers engaged
SANITARY WASTE	• Total quantity – 0.951 tonnes • Special zip covers – 4100 nos • Community incinerators and double chamber incinerator • Two vehicles provided
BIOMEDICAL WASTE	• Total quantity – 3.157 tonnes • Disposed through IMAGE (Common biomedical facility)
TEMPORARY TOILET FACILITIES	• 39 bio toilets provided to the camps • 7 nos. at the affected area • Cleaning staff were engaged
DISPOSAL OF ANIMAL tCARCASSES	Carcasses of wild animals and domestic animals were collected and disposed of in pits of large size and depth following the guidelines of animal husbandry

Table 16-4: *Activities undertaken as apart of waste management in response to landslide*

Figure 16-8: *Soil recovery in the landslide affected area*



16.7. Recovery & Reconstruction

Soil Recovery

Land stabilization through bioengineering works

Bioengineering works have emerged as a promising and innovative approach to landslide stabilization, offering a sustainable and environmentally friendly solution to a pressing issue. Landslides are a natural hazard that can have devastating consequences, causing damage to infrastructure, loss of life, and disruption to communities. Traditional engineering methods for landslide stabilization often involve the use of hard structural measures, these methods can be expensive, have high maintenance costs, and may have negative impacts on the surrounding environment.

In contrast, bioengineering works utilize natural materials and vegetation to stabilize slopes and prevent landslides. By harnessing the power of nature, these methods offer a range of benefits that make them an attractive option for landslide mitigation.

Here we are focusing on bio engineering works for the mitigation of landslides that occurred in Mundakkai. The proposed works are listed below:

1. Diversion Channel

Diversion channels are designed to redirect the flow of water and prevent it from accumulating in vulnerable areas, such as on slopes prone to landslides. By diverting water away from areas at risk of landslides, diversion channels help to reduce the overall amount of water that can infiltrate the ground and increase the likelihood of a landslide occurring.



2. Gabion Retaining Wall

Gabion retaining walls are structures made of wire mesh containers filled with stones or other materials. They are commonly used in landslide mitigation work to stabilize slopes and prevent soil erosion. It is effective in reducing the risk of landslides by providing structural support to the soil and preventing it from moving downhill. The flexibility and permeability of gabion retaining walls allow water to flow through them, reducing hydrostatic pressure behind the wall and minimizing the risk of soil saturation and slope failure.



3. Stone-pitched graded bunds

Stone-pitched graded bunds are structures constructed using a combination of stones and soil to create a sloping barrier along a vulnerable slope. It is effective in controlling surface water runoff and preventing erosion by providing a stable surface for water to flow over and infiltrate into the soil. The sloping design of stone pitched graded bunds helps to distribute the weight of the soil and water evenly, reducing the pressure on the slope and minimizing the risk of landslides.



4. Wild reed plantation

Wild reed plantation involves planting tall, resilient grasses such as wild reeds along vulnerable slopes to help stabilize the soil and reduce the risk of landslides. Wild reeds have deep root systems that help to bind the soil together and prevent erosion. The dense network of roots also helps to absorb excess water, reducing the likelihood of soil saturation and slope failure. they are fast-growing plants that can quickly establish themselves on slopes, providing a natural and cost-effective solution for landslide mitigation. In addition to stabilizing the soil, wild reeds can also act as a natural barrier to control surface water runoff and reduce the impact of heavy rainfall on the slope. Planting wild reeds on slopes can enhance the biodiversity of the area and create habitat for wildlife, further contributing to the ecological value of the site.





5. Coir geotextile textiles with Vetiver grass plugging

Coir geotextile textiles are made from natural fibers derived from coconut husks and are used to stabilize slopes and prevent erosion. These textiles are biodegradable, environmentally friendly, and have high tensile strength. Vetiver grass (Chrysopogon zizanioides) is a deep-rooted, perennial grass that is known for its strong root system, which can reach depths of three to four meters. The roots of Vetiver grass help to bind the soil together, providing slope stabilization and reducing the risk of landslides. The combination of coir geotextile textiles and Vetiver grass plugging creates a natural and sustainable solution for landslide mitigation. The geotextile textiles can be used to reinforce the soil and provide initial stabilization, while the Vetiver grass roots further strengthen the slope over time.



before



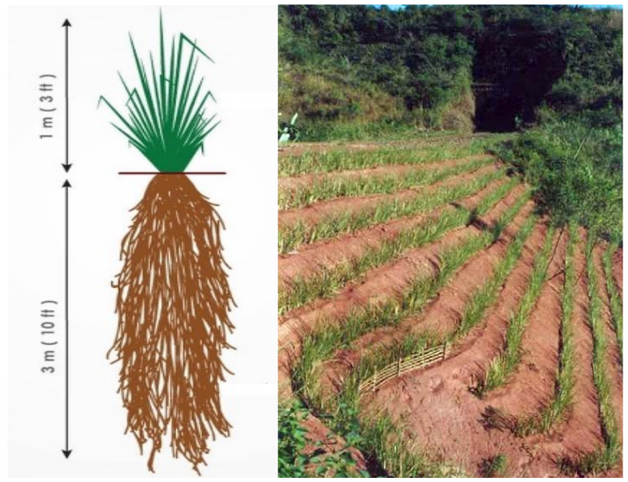
after

6. Road water diversion channels

These channels are typically constructed along roadways to capture and redirect surface runoff, preventing it from pooling or flowing directly onto slopes. This helps to reduce the amount of water that can infiltrate the ground and destabilize the slope. Vegetation can be planted along road water diversion channels to help stabilize the soil, reduce erosion, and enhance the channel's effectiveness in managing water flow. Native plant species are often recommended for their ability to thrive in the local environment.

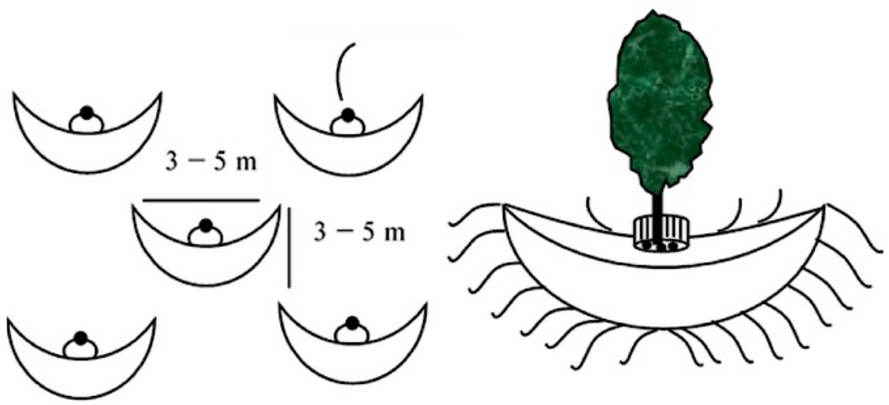
7. Vetiver plantations

Planting Vetiver grass in plantations along vulnerable slopes can help to reinforce the soil, pre-vent erosion, and control surface water runoff. The grass acts as a natural barrier that slows down water flow, reducing its erosive force on the slope. Vetiver grass is drought-tolerant and low maintenance, making it a cost-effective and sustainable solution for landslide mitigation in areas prone to soil erosion and slope instability. It can be established on hillsides, embankments, and other sloping areas where landslides are a concern. The grass can be planted in rows or blocks to maximize its effectiveness in stabilizing the slope.



8. Planting indigenous varieties of trees with crescent bunds

Indigenous trees are well-adapted to the local climate, soil conditions, and ecosystem, making them a natural choice for planting in landslide-prone areas. These trees can help stabilize the soil with their extensive root systems and provide additional protection against erosion. Crescent bunds are curved embankments constructed along the contours of a slope to slow down water runoff. When combined with planting indigenous trees, they can help intercept and redirect water flow, reducing the erosive force on the slope and minimizing the risk of landslides. Planting trees on the upslope side of crescent bunds can further stabilize the soil and enhance the effectiveness of the bunds in controlling water flow. The roots of the trees help bind the soil together, reducing erosion and strengthening the slope. Indigenous trees also offer additional environmental benefits, such as improving air quality, enhancing biodiversity, and providing habitat for wildlife. By planting a diverse range of tree species, we can create a resilient and ecologically valuable landscape.

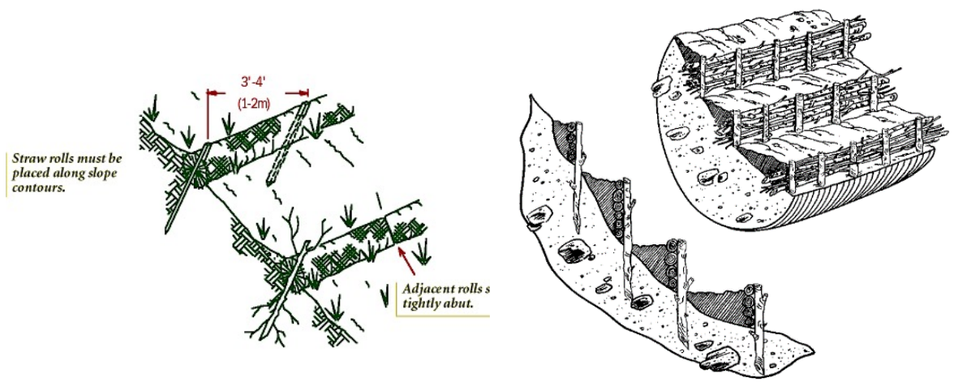


9. Contour wattling

Wattling is a traditional method for landslide mitigation that involves using woven or intertwined branches, twigs, and other plant material to create barriers or structures on slopes. The woven structures created through wattling help to strengthen the slope by providing additional support and preventing soil erosion. These structures can also slow down water runoff and reduce the erosive force on the slope. Wattling is a versatile technique that can be adapted to different slope conditions and site-specific factors. It is often used in areas where traditional engineering solutions may not be feasible or where a more natural and sustainable approach is desired. Wattling can also contribute to enhancing biodiversity and creating habitat for wildlife in the area where it is implemented. The natural materials used in wattling structures can blend in with the surrounding environment and provide additional ecological benefits.

10. Channel rectification

Channel rectification is a method used for landslide mitigation that involves improving the design and alignment of natural or man-made water channels to reduce erosion, control water flow, and minimize the risk of landslides. Channel rectification aims to stabilize water channels by correcting any irregularities, such as steep gradients, sharp bends, or inadequate drainage capacity, that may contribute to erosion and slope instability. By optimizing the alignment, slope, and dimensions of the channel, rectification helps to improve the smooth and efficient conveyance of water, reducing the likelihood of excessive erosion and sediment deposition that can trigger landslides. Proper channel rectification can help to prevent water overflow, reduce the accumulation of sediment and debris, and maintain the stability of the slope adjacent to the channel.



Proposed Soil Recovery Works

SL	Work	Quantity	Location	Unit cost	Amount (Lakhs)
1	Removal of debris	1000 m3	As per site condition	300/m3	3.00
2	Diversion channel	1000m	As per site condition	6750/Rm	67.50
3	Gabion- Retaining wall	500 m Length, 3 m height	Padavettikkunnu-School Junction	30000/Rm	150.00
4	Stone Pitched Graded bund	6000m	Patches of Mixed crop land Adjoining to forest	250/Rm	15.00
5	Wild reed Plantation	15000 nos	Various locations, From punchirimattam to Chooralmala	120/nos	18.00
6	Slope Protection Using Coir Geotextiles with Vetiver plugging	20000 m2	Various locations, From punchirimattam to Chooralmala	400/m2	80.00
7	Road Water Diversion Channel	1000 m	Mundakkai-Punchirimattam-School road	75/Rm	0.75
8	Vetiver Plantation	10000 nos	Various locations, From punchirimattam to Chooralmala	50/nos	5.00
9	Planting Indigenous varieties of trees with crescent bund	1000 nos	Patches of Mixed crop land	2000/ nos	20.00
10	Wattling	500 m	Puchirimattam,Near tea factory	300/m	1.50
11	Channel Rectification	300 m	Reconstruct the filled drains	215/m	0.645
	TOTAL				**361.40**
	Total in Crores				**3.614**

Table 16-5: *Proposed soil recovery works*

Table 16-6: Forest Recovery Plan – Cost estimate

Sl. No.	Activities	Cost Estimate (in Lakhs)
1	Aerial Seeding/ broadcast Seeding	4 lakhs
2	Afforestation – Nursery & restoration works	28 lakhs
3	River bank vegetation restoration	39.9 lakhs
	Total INR	**71.9 Lakhs**
	Total in Crores INR	**0.719**

FOREST – RECOVERY PLAN

The forest recovery plan suggested here includes various strategies to recover the forest growth in these areas in order to account for the forest area loss. Since most of the landslide affected area were not used for habitation, the forest area especially the riverine vegetation will be restored through various strategies. The increasing tourism entrepreneurship in the area were due to the aesthetic value of the forest in this area and it also acts as a connectivity region for the wildlife.

The following activities are proposed considering the slope and topography and the land use.

1. **Broadcast seeding or aerial seeding** of indigenous species in the upper reaches of Punnapuzha. (Estimated cost – 4 lakhs)

2. **Afforesting the 5.16 ha** DPEP bit – The forest which was on the bank of the punnappuzha near Mundakkai LP school was washed away due to the landslide debris flow. This portion can be afforested using Bamboo, reed cane etc and further on the upper reaches indigenous varieties can be tried. The sub activities involve raising a nursery, planting operations, maintenance up to five year and casualty replacement.

The financial requirements and details are as follows:

3. **River bank stabilisation through vegetation restoration** - On both the side banks of Punnappuzha – for a length of 6 km and width of 10 m on either side - It is proposed to stabilise the banks with natural indigenous species of riverine nature.

Total area of 6 ha on both banks – a total of 12 ha

Estimated cost including maintenance cost for 5 years - 18,60,000 /- (12 ha X 3750 plants X 62) + 12,00,000 (maintenance cost)

WASTE MANAGEMENT

The waste management strategy in the post landslide scenario for recovery and reconstruction can be of following steps:

- Guidelines for waste management in the affected areas
- Waste management plan for the proposed township

Waste management during restoration of affected areas

- Debris form the demolished houses during the land slide shall be properly collected and the bricks, concrete structures, windows, doors and steel bars shall be segregated. Such segregated materials shall be transferred for reuse and recycling.
- E-wastes such as Television parts, computer peripherals, fridges and other electrical and electronic equipment collected and transferred for authorized E-waste collection centres.

Table 16-7 Cost estimate for setting up a forest nursery

Sl. No.	Activity	Unit cost	No of Units	Estimated amount (in Lakhs)	Remarks
1	Raising Nursery	62/tall basket	12500	7,75,000/-	Indigenous species like bamboo, reeds, cane, vetiver etc.
2	Planting including maintenance for five years	lumpsum		15,00,000/-	
3	Fencing			5,25,000/-	
	Total			**28,00,000/-**	

- Lot of vehicles like car, two wheelers also seen in the debris, these also be separately collected and disposed via recyclers.
- Other scraps like kitchen utensils, iron and wooden furniture also be collected and removed from the debris.

Waste management during construction phase

- All required sanitary and hygienic measures should be provided before starting construction activities and to be maintained throughout the construction phase.
- Adequate drinking water and sanitary facilities should be provided for construction workers at the site, Provision should be made for mobile toilets. The safe disposal of wastewater and solid wastes generated during the construction phase should be ensured.
- All the topsoil excavated during construction activities should be stored for use in horticulture/landscape development within the project site.
- Disposal of muck during construction phase should not create any adverse effect on the neighbouring communities and be disposed taking the necessary precautions for general safety and health aspects of people, only in approved sites with the approval of competent authority.
- Construction spoils including bituminous material and other hazardous materials' must not be allowed to contaminate watercourses and the dump sites for such material must be secured so that they should not leach into the ground water.
- The diesel generator sets to be during construction phase should be low sulphur diesel type and should conform to EP [Environment Protection] –Rules prescribed for air and noise emission standards.
- Ambient noise levels should conform to residential standards both during day and night. Incremental pollution loads on the ambient air and noise quality should be closely monitored during construction phase.
- Fly ash should be used as building materials in construction as per the provisions of Fly Ash Notification September 1999.
- Ready mixed concrete must be used in building construction.
- Water demand during construction should be reduced by use of premix ed curing agents and other practises referred.
- Separation of grey and black water should be done by the use of dual plumbing system.

- Fixtures for showers, toilet flushing and drinking should be of low flow either by use of aerators or pressure reducing devices or sensor-based control.

- Use of glass may be reduced by up to 50% to reduce the electricity consumption and load on air conditioning.

- Roof should meet perspective requirement as per Energy Conservation Building Code by using appropriate thermal insulation material to fulfil requirement.

- Opaque wall should meet perspective requirement as per energy conservation Building code which is proposed to be mandatory for all air conditioned spaces.

- The approval of the competent authority shall be obtained for structural safety of the buildings due to earthquake, adequacy of firefighting equipments, etc. as per National, Building Code including protection measures from lightening etc.

Waste management in the proposed township

- Expected families to be rehabilitated is around 2000 families depending on the terrain, slope and other geological conditions.

- Considering 5 members per family, expected number of persons in the residential area is 10,000 and expected population flux is around 5000 at the peak.

- Water requirement as per IS code IS 1172:1993, for communities with population 20,000 to 1,0,000 together with full flushing system is 100 to 150 LPD for other commercial buildings it will be around 50 LPD.

- Then the water requirement for the residential area total water consumption is 15, 00,000 LPD (1500 KLD) and for commercial area it is 25,000 LPD (25 KLD). So total water consumption is 1525 KLD.

- Considering wastewater generation is 80% of the water consumption, total wastewater generation is 1350 KLD.

- Considering the future expansion, we may propose 1500 KLD or 1.5 MLD wastewater treatment plant for the entire town ship, if the proposed area is in one stretch. Otherwise, separate treatment plants shall be provided sector wise.

- Since the proposed area is in a rural area and ecological sensitive area, we are recommending eco-friendly treatment system with low capital cost and operational cost compared to conventional treatment facility.

As part of the wastewater treatment in the township, a constructed wetland system is proposed which is eco-friendly and not power intensive.

Constructed wet land system (CW) is an artificially created manmade wastewater system by utilizing natural processes, involving filter media, vegetation and microbial communities. CWs offer an environmentally friendly and cost-effective solution to the wastewater treatment by harnessing natural processes involving wetland vegetation and microorganisms and remove pollutants from wastewater including nutrients and organic matter.

The stages of treatment are as follows:

CWs are engineered systems that use natural processes to treat wastewater. The design requirements for CWs depend on several factors, including the system's size, the wastewater's characteristics, and the desired level of treatment.

The CWs treatment technology may involve a series of networks of pipes, pumping stations, and primary treatment, secondary and tertiary treatment depending upon the end use. Process flow of CWs based STPs is given in the following Figure.

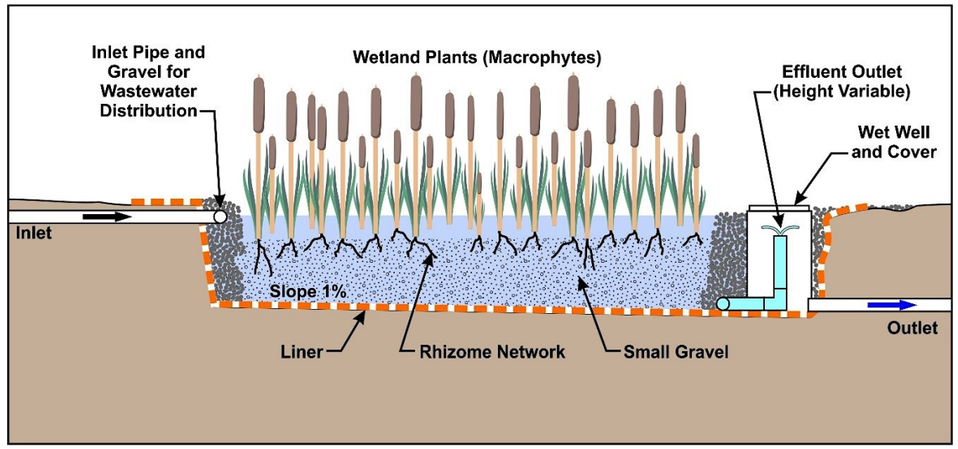
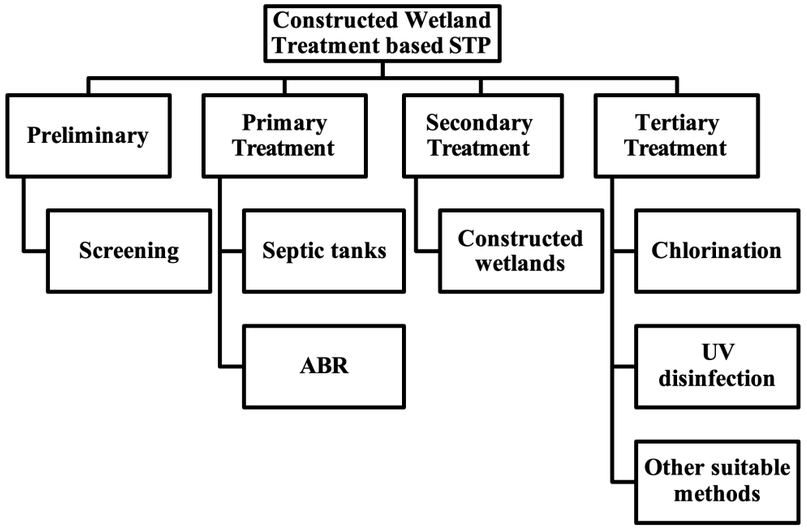


Figure 16-9 *Schematic of the Horizontal Subsurface Flow Constructed Wetland*

Figure 16-10: *Process flow chart for Subsurface Flow Constructed Wet Land System (SSFCW)*



Process flow of CWs based STPs

- Merits of this type of treatment plant is
- Low operational and maintenance cost
- Low energy demand
- Good treatment efficiency
- Reuse of the treated wastewater for flushing, gardening, irrigation and floor washing is lower the water consumption to a larger extend.
- For achieving the standards for the reuse tertiary units such as filtration units (PSF, ACF & UF) should be provided.
- The installation of the Treatment Plant (STP) should be certified by an independent expert a report in this regard should be submitted before the project is commissioned for operation. Treated affluent emanating from STP shall be recycled / reused to the maximum extent possible. Treatment of 100% grey water by decentralised treatment should be done. Discharge of unused treated affluent shall conform to the norms and standards of the Kerala State Pollution Control Board. Necessary measures should be made to mitigate the odour problem from STP.

The assumptions related to the proposed township are given below and the estimates related to the wastewater generation and the system costs are calculated based on these assumptions.

SCENARIO 1 – 1000 HOUSES					
Sl. No.	**Type of Building**	**Population**	**Generation of Grey Water (KLD)**	**Generation of Black Water (KLD)**	**Proposed Technology**
1	Houses (1000 No's)	5000	525	225	Proposed Constructed Wet Land Treatment based STP @ 1 MLD Capacity. Estimated Cost of INR 2.5 Cr
2	Schools	600	15	6.48	
4	Anganwady Buildings	130	3	1.5	
5	Hotels	120	4.7	2	
7	Commercial Area	250	2.1	1	
8	Health Centre	300	11	5	
9	Park	100	0.5	0.3	
10	Govt. Institutions	100	2.5	1	
11	Skill Training Centre	100	2.5	1.1	
12	Religious Institutions	300	1.7	0.7	
13	General Area	500	2.8	1.2	
14	Tourism Sector	500	2.8	1.2	
15	Floating Population	2000	11.4	5	
	Total		**585**	**251.48**	**836.48**

Table 16-8: *Waste water management in the proposed township - Scenario 1*

SCENARIO 2 – 2000 HOUSES					
Sl. No.	Type of Building	Population	Generation of Grey Water (KLD)	Generation of Black Water (KLD)	Proposed Technology
1	Houses (2000 No's)	10,000	840	360	
2	Schools	900	23	9.75	
4	Anganwady Buildings	200	7.2	2.7	
5	Hotels	200	7.84	3.4	
7	Commercial Area	500	2.8	1.2	
8	Health Centre	400	28	12	Proposed Constructed Wet land Treatment based STP @ 1.5 MLD Capacity. Estimated Cost of INR 4 Crores
9	Park	200	0.9	0.39	
10	Govt. Institutions	150	3.4	1.4	
11	Skill Training Centre	200	4.9	1.5	
12	Religious Institutions	500	2.8	1.2	
13	General Area	750	4.2	1.8	
14	Tourism Sector	750	4.2	1.8	
15	Floating Population	3000	16.8	7.2	
	Total		**946.5**	**404.34**	**1350.84**

Table 16-9: *Waste water management in the proposed township - Scenario 2*

SOLID WASTE MANAGEMENT - COMPONENTS AND CONSTITUENTS

Primary collection is the first and prime activity in Solid Waste Management. For Planning and designing effective, sustainable and cost effective and efficient primary collection system, the following information shall be established for each Ward / town/ City.

- Present & future growth of the population
- Waste generation per capita/day
- Quantity of waste generated per day
- Area
- Population density
- Physical Characteristics
- Chemical Characteristics & Toxic Characteristics

For solid waste management two separate streams proposed, wet waste and dry waste. For collecting wet waste (Bio degradable) and various dry waste (Non-biodegradable) such as plastic, paper, glass, E-waste and domestic hazardous waste five coloured bins proposed for every residential building.

The cost analysis for wet waste processing and dry waste collection with recovery facility is given in the tables.

Sl.No	Component	Constituents
1	Manpower and Implements	• Man Power - Sanitation workers in local body • Contract workers • NGO / CBO - Voluntary agencies workers • Implements Tools and Plants • Primary collection vehicles • Containerised Hand Carts • Wheelbarrow • Storage Depots (Dust bins / Open Collection /Depots) • Welfare Measures for Workers
2	Source / Storage	Quantity of Garbage generated • Source of generation • Physical and Chemical Characteristics of garbage • Length of road • Width of road • Collection points (Dust bins / open collection) • Transfer Points (Depots / Transfer Station / Sub Depots) • Distance between the collection points • Distance between the Transfer points • Quantity at collection points / Transfer points • Payload capacity of the vehicle
3	Vehicle & Machinery	Vehicles • Tipper • Non - Tipper • Make • Ordinary body truck • Stainless Steel lined body

Table 16-10: *Waste management components and constituents*

Table 16-11: Waste management for township with 1000 families

Sl. No.	Nature of Building	Population	Biodegradable (Kg/Day)	Non-Biodegradable (Kg/Day)
1	Residential Area PC @ 0.3	5000	900	600
2	Floating PC -@ 0.1	5000	400	100
	Total		1300	700
Cost Analysis of Solid Waste Management				
DRY WASTE PROCESSING				
Sl. No.	**Nature of Work**	**Numbers**	**Cost or Area/ Unit - INR**	**Total – INR in Lakh**
1	5 Coloured Bins	1000	2000	20
2	MCF with Recovery Facility (2000 Sq Feet)	1	3500000	35
3	Mini MCF (200 Sq Feet)	3	250000	7.5
4	Battery operated good Vehicle	2	1300000	26
5	Sorting Table and Bailing machine	1	1000000	10
6	PPE			2
7	Man power / Month	12	360000	3.6
WET WASTE PROCESSING				
8	Fully Covered Vehicle for Wet waste management	3	600000	18
9	Wheel Barrows	10	6000	6
10	Wet Waste Processing Plant (3000 Sq Feet)	1	4500000	45
11	Waste Processing Machine - Organic Waste Converter (OWC)	1	1500000	15
12	Windrow Compost Turner Machine	1	1500000	15
13	PPE			2
14	Manpower / Month	20		6
15	Sanitary Waste Destroyer	1	5000000	50
	Total			**261.1**

Table 16-12: Waste management for township with 2000 families

Sl. No.	Nature of Building	Population	Biodegradable (Kg/Day)	Non-Biodegradable (Kg/Day)
1	Residential Area PC @ 0.3	10,000	1800	1200
2	Floating PC -@ 0.1	5000	400	100
	Total		2200	1300
Cost analysis of Solid waste management				
DRY WASTE PROCESSING				
Sl. No.	**Nature of Work**	**Numbers**	**Cost or Area/ Unit - INR**	**Total - INR in Lakh**
1	5 Coloured Bins	2000	2000	40
2	MCF with Recovery Facility (3500 Sq Feet)	1	3500000	42
3	Mini MCF (200 Sq Feet)	5	250000	12.5
4	Battery operated good Vehicle	3	1300000	39
5	Sorting Table and Bailing machine	2	1000000	20
6	PPE			3
7	Man power / Month	15		4.5
WET WASTE PROCESSING				
8	Fully Covered Vehicle for Wet waste management	5	600000	30
9	Wheel Barrows	15	6000	0.9
10	Wet Waste Processing Plant (4000 Sq Feet)	1	4800000	48
11	Waste Processing Machine - Organic Waste Converter (OWC)	1	2000000	20
12	Windrow Compost Turner Machine	1	1500000	15
13	PPE			3
14	Manpower / Month	25		7.5
15	Sanitary Waste Destroyer	1	5000000	50
	Total			**335.4**

Table 16-13: *Cost estimate for waste management in theproposed township*

Sl. No.	Activities	Estimate (in Crores)
1	Liquid waste management (for 1000 families) 1 MLD	2.5
2	Liquid waste management (for 2000 families) 1.5 MLD	4.0
3	Solid waste Management (for 1000 families)	2.61
4	Solid waste Management (for 2000 families)	3.35
	Total (1000 families)	**5.11**
	Total (2000 families)	**7.35**

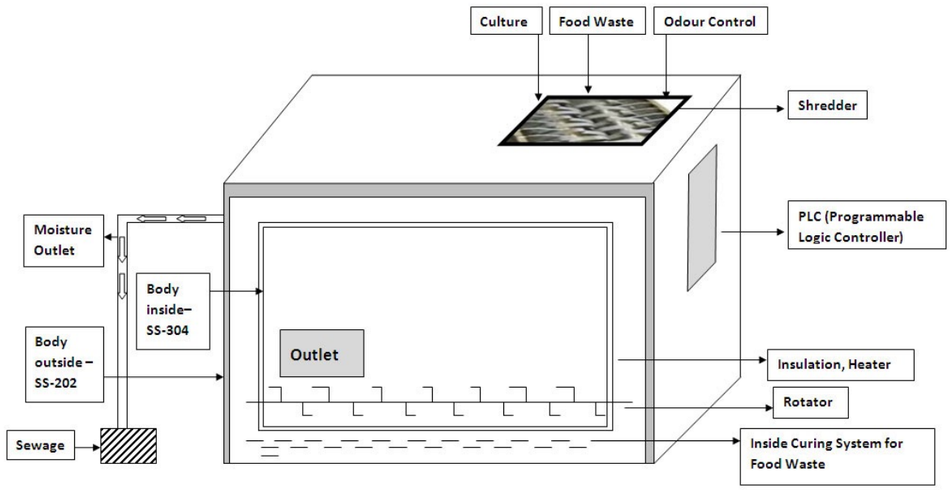


Figure 16-11: *Food Waste Compost Machine and Waste Converter Machine*

[11] *An organic waste converter is a self-contained unit that speeds up the composting produces and produces better compost. The raw material first mixed with water to make an input ready mixture. From the input section, this waste is fed to the machine. The device includes a mechanism for introducing microorganisms into the mix. Some holes provide air to the mixture. A stirring shaft mixes the waste mixture with microorganisms. The temperature inside the machine rises to 50-60 degree Celsius and within 24-28 hours the organic matter converted into compost.*



Figure 16-12: *Material collection and recovery facility*

Figure 16-13: *Coloured bins for waste storage in individual houses*





Figure 16-14: *Personnel Protective Equipment's*

References:

1. Guidelines for constructed wetland systems for treatment of sewage in India-2023, sponsored by The National Mission for Clean Ganga (NMCG), the Ministry of Jal Shakti, Government of India prepared by Department of Hydro and Renewable Energy, Indian Institute of Technology Roorkee.

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2. IS code IS 1172:1993

3. Guidelines for Utilisation of Treated Effluent in Irrigation, CPCB –September -2019

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4. Manual on Municipal Solid Waste Management prepared by Central Public Health & Environmental Engineering Organisation (CPHEEO)

RECONSTRUCTION AND RECOVERY ESTIMATES – FOREST & ENVIRONMENT

The reconstruction and recovery estimates of the sector involves three subsections

1. Forest recovery
2. Soil recovery
3. Waste managment in the proposed Township

Item nos 1 & 2 are considered as part of the recovery plan and waste managemnt in the township is considered as the reconstruction plan.

The total cost of the recovery is INR 4.33 crores and that of the reconstruction is INR 7.354 crores.

Forest and Environment Sector _ Cost Estimates (in INR crores)			
RECOVERY	Soil	3.614	Soil recovery Plan
	Forest	0.719	Forest Recovery Plan
TOTAL		**4.33**	
RECONSTRUCTION	Waste Management	7.354	Waste Management plan for the new township
GRAND TOTAL	**Reconstruction & Recovery**	**11.684**	

Table 16-14: Forest and Environment sector-Recovery and Reconstruction cost estimate



17



Social Inclusion – Children, Tribals, Elderly, Persons With Disability, Migrant Labourers, Extreme Poor & Gender Perspectives

17.1. Social Inclusion in Disaster Risk Reduction: Focus on Vulnerable Groups

The Sendai Framework for DRR 2015-2030 marked a significant milestone by formally recognizing social inclusion within disaster risk reduction (DRR) efforts. The framework specifically emphasized the need to include vulnerable groups such as women, children, youth, persons with disabilities, older persons, indigenous peoples, and migrants laborers in all aspects of DRR planning, implementation, and response.

Table 17-1: *Consolidated Recovery Costs for Vulnerable Groups*

Sl. No.	Vulnerable Group	Amount Required (in crores)
1	Children	3.60308
2	Senior Citizens	0.84032
3	Persons with Disabilities	0.4621
4	Women	0.815494
5	Indigenous Community	0.645972
6	Transgenders	0.411
7	Migrants	0.4593
	Total	**7,237,266**

These principles of social inclusion are further reinforced by the National Disaster Management Act 2005 and related sector-specific legislation, including the Disabilities Act and the Juvenile Justice Act. These laws provide a legal framework for ensuring that the needs and rights of vulnerable populations are considered and addressed in disaster management strategies.Kerala remains steadfast in its commitment to implementing inclusive DRR programs, particularly for vulnerable segments of society. In 2015, the Kerala State Disaster Management Authority took a significant stride by launching disability-inclusive DRR initiatives, which subsequently garnered recognition from the National Disaster Management Authority. Building upon this progress, Kerala is currently developing a transgender-inclusive DRR program to ensure that transgender and queer individuals are fully integrated into disaster management efforts.

The Wayanad District Disaster Management Authority (DDMA) has demonstrated pioneering efforts by creating disaster management plans tailored explicitly for tribal hamlets. These plans aim to equip indigenous communities with the necessary tools and knowledge to respond effectively to natural disasters and emergencies. Furthermore, Kerala has embraced innovative approaches to disaster education, such as disaster management games for children. These games, showcased at the "Keraleeyam 2023"[12] event, garnered widespread acclaim for their novel and practical learning approach.

[12] *Kerala State Disaster Management Authority [2023], Keraleeyam 1.11.2023 – 7.11.2023 Capacity Building for Aapda Mitra, Civil Defence Volunteers and Children, Government of Kerala.*

To ensure comprehensive disaster preparedness and response, Kerala has tailored DRR programs to meet the specific needs of the elderly and palliative care patients. This demonstrates the state's unwavering commitment to inclusive and comprehensive disaster management strategies.

The Wayanad PDNA accentuates social inclusion's critical importance in effective post-disaster recovery efforts. The assessment identifies several vulnerable groups that require specialized attention, including:

- Persons with disabilities
- Transgender individuals
- Elderly individuals (elderly-only households)
- Women (women-only households)
- Children (orphans, semi-orphans, and children-only households)
- Migrant laborers (In this document, the term "migrant laborer population" refers to individuals who have migrated to Kerala for employment purposes and are engaged in various occupations such as plantation work, hospitality, construction, and street vending, among others)
- Indigenous communities

The scope of this assessment is twofold:

1. **Assessing the Impact on Vulnerable Groups:** The PDNA evaluates the specific challenges and needs these groups encounter in the context of landslide-related disasters.

2. **Promoting Inclusive Recovery:** The assessment aims to ensure that recovery efforts are designed and implemented to address the unique requirements of vulnerable populations, fostering a "build back better" approach.

Given the cross-cutting nature of social inclusion, the assessment of damages, losses, and reconstruction costs was integrated into the analysis of other relevant sectors, such as shelter, livelihoods, and infrastructure.
The data presented in the PDNA underlines the significant financial resources necessary to support vulnerable groups in Wayanad following the disaster.

The estimated total amount of INR 7,23,72,660 highlights the urgent need for comprehensive and inclusive recovery efforts to effectively address these marginalized populations' specific needs.

17.2. Social Inclusion and Children

For this assessment, the focus on children within the social inclusion framework has been limited to those who have experienced the loss of one or both parents as a direct result of the disaster.

While children with disabilities have been identified as a vulnerable population, their specific needs are addressed in a separate section of the assessment.

17.3. Impact on Children

- **Loss of Life:** A tragic loss of life occurred, with 36 children (16 girls and 20 boys) perishing in the landslides.

- **Orphanhood:** The disaster resulted in six children (two girls and four boys) becoming fully orphaned, while seven children (four girls and three boys) lost one parent.

- **Age Distribution:** The ages of the fully orphaned children range from 0 to 18, with a significant number (four) between the ages of 6 and 15. The majority of semi-orphaned children are in the 0-5 age group.

- **Children with Disabilities:** Notably, twenty children, including ten with intellectual impairments and ten with locomotor disabilities, were affected by the disaster.

Educational Disruption

- **School Closure:** Both the government schools in the affected areas were destroyed entirely. Aided schools are being utilized as relief camps, leading to a month-long disruption in formal education for students.

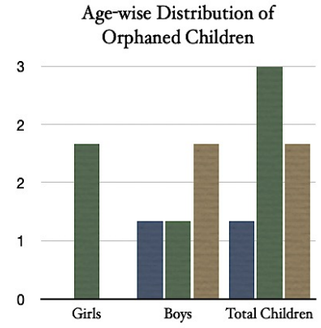
- **Online Classes:** To mitigate the impact of

The table provides a breakdown of orphaned children in Wayanad district based on their age and gender.

- The majority of orphaned children are in the 6-15 age group.
- There is a higher proportion of male orphans compared to female orphans.
- The total number of orphaned children is relatively small.

Distribution of Orphaned Children in Wayanad

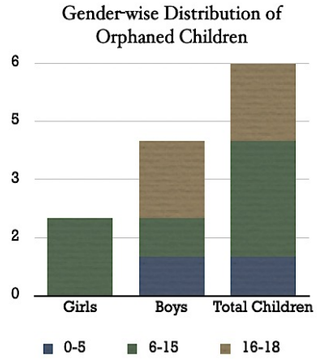
Age-wise classification	Girls	Boys	Total Children
0-5	0	1	1
6-15	2	1	3
16-18	0	2	2
Total	2	4	6



This chart compares the number of orphaned children by age group, gender, and overall total.

Findings:

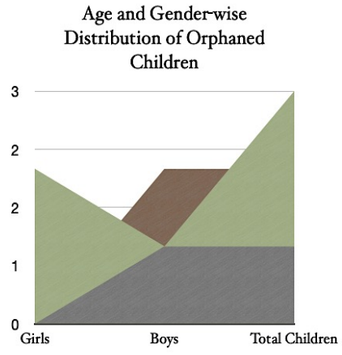
- The 6-15 age group has the highest number of orphans.
- The number of male orphans is slightly higher than female orphans.
- The total number of orphans is relatively low.



This chart presents the consolidated total number of orphaned children by gender.

Findings:

- The total number of orphaned children is relatively small.
- There is a slight imbalance in gender distribution, with a slightly higher number of male orphans.



This chart visually represents the distribution of orphaned children by age group and gender.

Findings:

- The 6-15 age group dominates the chart, indicating the highest number of orphans in this category.
- The chart visually highlights the gender imbalance, with a slightly higher proportion of male orphans.

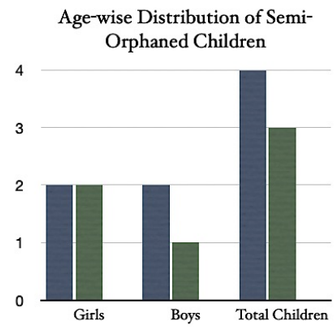
Distribution of Semi Orphaned Children in Wayanad

The table provides a breakdown of semi-orphaned children in Wayanad district based on their age and gender.

Findings:

- The majority of semi-orphaned children are in the 0-5 age group.
- There is a slight imbalance in gender distribution, with slightly more female semi-orphaned children than male.
- The total number of semi-orphaned children is relatively small.

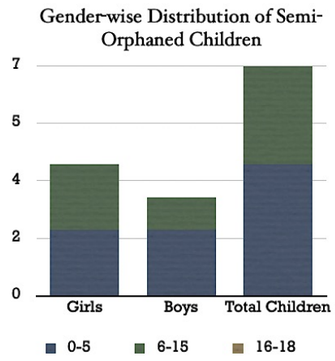
Age-wise classification	Girls	Boys	Total Children
0-5	2	2	4
6-15	2	1	3
16-18	0	0	0
Total	4	3	7



This chart represents the distribution of semi-orphaned children by age group.

Findings:

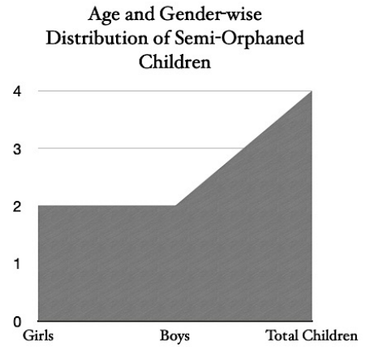
- The 0-5 age group has the highest number of semi-orphaned children.
- The number of semi-orphaned children decreases with age.



This chart compares the number of semi-orphaned children by gender.

Findings:

- There are slightly more female semi-orphaned children than male.



This chart combines the age and gender distributions of semi-orphaned children.

Findings:

- The 0-5 age group has the highest number of semi-orphaned children, with a slight majority being female.
- The number of semi-orphaned children decreases with age, and the gender distribution remains relatively balanced across age groups.

school closures, online classes have been implemented for students in grades 10 and 12 at one of the schools.

- **Integration Plan:** A plan has been devised to integrate students from the damaged schools in Vellarmala and Chooralmala into undamaged schools in Meppadi for the current academic year.

- **Additional Support:** Additional support measures may be necessary to ensure that children with disabilities and tribal children living in remote areas can continue their education uninterrupted.

Challenges for Higher Education

- **Financial Constraints:** The loss of a primary breadwinner has severely impacted the ability of certain children to continue their education, particularly those pursuing higher studies in other districts, states, or countries.

Cross-Cutting Issues

The general costs of recovery and rehabilitation for children are cross-cutting issues that impact education, housing, psychosocial wellbeing, and livelihoods. This section specifically addresses the rehabilitation of the most vulnerable children—those who have lost one or both parents.

17.4. Immediate Requirements

1. Ensuring Holistic Child Development

A tailored approach is imperative to facilitate the holistic development of each affected child. Developing Individual Child Care Plans, especially for orphaned children, will ensure their unique needs and aspirations are met. This individualized approach will empower children to thrive and reach their full potential within a supportive and caring environment.

2. Foster Care Support: Promoting Familial Connections

Given the significant trauma experienced by affected children, it is strongly recommended that they be placed with close relatives with whom they feel a sense of comfort and belonging. This approach aligns with the guidelines outlined in the Juvenile Justice (Care & Protection) Act and the Department of Women and Child Development.

Kinship care support has been initiated at INR 4,000 per child per month. This support should be continued as long as the child remains within the family, with regular adjustments to account for inflation over time, particularly considering the suggested average duration of eight years. The adjusted amount should be incorporated into budget calculations to ensure adequate financial support. To safeguard the ongoing wellbeing of the child, it is imperative that relevant authorities and government agencies continuously monitor and support their development. This includes providing necessary resources, services, and follow-up care to ensure the child's optimal growth and recovery.

3. Strengthening Child Welfare Committees

To effectively monitor and safeguard the wellbeing of affected children, it is imperative to establish or reactivate Panchayat-level Child Welfare and Protection Committees. These committees, led by the Panchayat President, should be empowered to oversee the ongoing welfare of children within their respective jurisdictions.

4. Assuring Educational Continuity

To ensure minimal educational disruptions for children affected by trauma or post-disaster challenges, it is recommended that they continue their studies within the region. This applies regardless of whether they attend private institutions or pursue higher education outside the district.

5. Addressing Outstanding Education Loans

The draft Micro-Plan for the affected population identifies thirty-one outstanding education loans. These loans should be reviewed and reassessed to determine appropriate measures for supporting the affected children, with a particular focus on those who have lost one or both parents.

6. Initiating Scholarship Fund

Similar to the existing scholarship programs for minority students, it is advisable to establish a scholarship fund specifically for the higher education of affected children. This fund should be allocated based on the academic performance of individual students.

Table 17-2: *Total Recovery Costs for Children*

Details	Unit Cost	No of Units	Total Cost (in crores)
Developing Individual Child Care Plan	Lump sum	-	0.025
Kinship Support @ INR 4000/pm for 8 years adjusted for 8% escalation (annually)	69600	6	0.33408
Provision for Scholarship for Higher Education	1000000	30	3.00
Skill Building support for Surviving parent/ Foster Care parents	25000	40	0.10
Livelihood Support for Surviving parent/ Foster-care parent	25000	40	0.10
Health care and Life Insurance support for Surviving parent/ foster parents	6000	40	0.024
Health Care Insurance for child	5000	40	0.02
Total			**360,308**

7. Specialized Care for Children with Disabilities

Ten children were identified as having intellectual impairments, necessitating specialized care. This includes psycho-social support and assistance to both parents/caretakers and children.

8. Livelihood Support for Caregivers/Surviving Parents

The Individual Child Care Plan should evaluate the income-earning capacity of the surviving parent or caregiver to determine their financial ability to support the child. Exploring alternative sustainable livelihood options can help ensure financial stability, and all necessary support should be provided to establish such livelihoods.

9. Skill Development for Caregivers

Based on the preferred livelihood options identified by the surviving parent or caregiver, appropriate training and skill development should be provided to ensure their proficiency in the chosen field.

MEDIUM TERM REQUIREMENTS

- **Health care and life insurance support for surviving parent/caregiver:**
  As a part of risk reduction and ensuring that the child is not subject to another traumatic upheaval in their lives, it is recommended that the surviving parent or caregiver is provided with Health and Life Insurance.

- **Health Insurance for children:**
  A paucity of funds should not be a factor in denying good health facilities for the child as and when required. The surviving parent or caregiver should be supported by ensuring a Health Insurance Coverage for the child.

Total Recovery Costs

Although 20 children with disabilities have been

identified, their requirements and cost for recovery initiatives have been listed in the section "Persons with Disabilities".

17.5. Social Inclusion and Elderly

Over the past six decades, Kerala has witnessed a substantial increase in its elderly population, with the percentage of individuals aged 60 and above soaring from 5.1% to 16.5%—the highest proportion among all Indian states. A study conducted by the Centre for Development Studies in 2013 (A survey on ageing scenario in Kerala) revealed that the state's elderly population is expanding at a persistent rate of 2.3% annually. This growth rate is particularly pronounced among those aged 70 and above.

The nuanced impacts of a disaster on this especially vulnerable population can be challenging to discern without a deliberate and focused effort. The post-disaster rescue and relief systems in Kerala have consistently demonstrated sensitivity in supporting vulnerable populations, particularly older people, during times of crisis.

Scope of the Assessment: Vulnerable Elderly Population

The assessment focused on the elderly population within the affected area, identifying 232 senior citizens who were directly impacted by the disaster. In accordance with the draft micro-plan, 32 households composed entirely of elderly individuals were identified as requiring specific support and assistance. These families primarily depend on social security pensions and have been prioritized for social inclusion initiatives.

17.6. Impact on the Elderly Population

While the majority of the 32 elderly-only households were relocated to relief centers or other safe locations, ten elderly individuals were living independently. Unfortunately, four of these individuals lost their primary caregivers, including sons and daughters, who had previously provided crucial support and assistance. Although nine individuals have been temporarily placed with family members, they have preferred independent living arrangements. They should be considered eligible for government-provided rental housing to honour their wishes. Although technically eligible, decision-making authorities may consider living with family members the best option. However, respecting their wishes and providing them with the final decision making capacity regarding their preferred living arrangement is crucial.

To effectively address the unique needs of the elderly population, the establishment of a Vayomitram day care center, managed by the Kerala Social Security Mission (KSSM), is recommended for Wayanad. Discussions with members of the Senior Citizen's Welfare Forum revealed a pressing need for assistive devices, access to essential services, and reliable transportation, particularly ambulances, for emergency medical care or evacuation.In alignment with the State Policy for Senior Citizens, which mandates the establishment of a Pakal Veedu (Day Care Home) in every panchayat, it is essential to promote these facilities within planned resettlement areas. This will ensure that elderly individuals can access the necessary support and services to maintain their well-being and independence.

Damages, Losses, and Recovery Efforts

The assessment of damages and losses, and the subsequent reconstruction efforts, are classified under the purview of the Housing Sector.

17.7. Recovery Initiatives for Senior Citizens

To support the wellbeing of senior citizens, several initiatives are being implemented:

- **Rent Support Mechanism:** Elderly individuals who were living independently should be included in the government's rent support mechanism to ensure adequate housing assistance.
- **Fostering Financial Independence:** To empower elderly individuals, particularly those who were previously dependent on their children, the government should support them in developing income-generating activities. This could include anything from selling lottery tickets to operating small businesses or participating in collective farming.
- **Shock-Responsive Social Protection Schemes:** In addition to the regular Old Age Pension, a temporary subsistence allowance is recommended for a period of six months to address the immediate financial needs of elderly individuals who may have experienced additional financial strain due to the disaster.
- **Establishment of Senior Citizen Forums:** To enhance community engagement and support, senior citizens aged 60 to 70 can form Senior Citizen Forums. These forums can serve as platforms for collective activities, early warning dissemination, evacuation facilitation, and identifying individuals with special needs.
- **Safe and Secure Community Centers:** Establishing Senior Citizen Centers, similar to Pakal Veedu or Vayomitram, can provide a safe and supportive environment for elderly individuals. These centers can also function as recreation centers, disaster shelters, and palliative care units.
- **Capacity Building for Senior Citizen Forums:** To ensure effective functioning, Senior Citizen Forums should be equipped with the necessary skills and resources. This includes training in leadership, communication, and community organizing.
- **Mental Health Wellbeing Support:** To enhance the mental health wellbeing of senior citizens, recreational facilities, group and individual counseling, and productive therapies should be made available.

Details	Unit Cost	No. of Units	Total Cost (in crores)
Rent Support for 12 months	6000	32	0.2304
Subsistence Allowance for 6 months	1000	32	0.0192
Skill Building	10000	50	0.05
Setting up Income Generating Activities	15000	25	0.45
Setting up Senior Citizen Forums	300000	2	0.06
Shock Responsive Social Protection allowance for 6 months	1600	32	0.03072
Total			**0.84032**

Table 17-3: *Cost of Recovery and Rehabilitation for Elderly*

17.8. Social Inclusion and Persons with Disabilities

Wayanad: A District Prioritizing Disability Inclusion

Wayanad is recognized as one of the aspirational districts in India, a distinction it uniquely holds within the state of Kerala. According to the 2015 Disability Census conducted by the Government of Kerala, Wayanad has a population of 23,122 individuals with disabilities, constituting approximately 2.75% of the total population.

In November 2018, the Kerala State Disaster Management Authority and Inter University Centre for Disability Studies (IUCDS) collaborated to provide training in Disability Inclusive DRR to 217 persons with disabilities in Wayanad. The landslide that occurred on July 30, 2024, had a profound impact on the lives of individuals with disabilities in Wayanad, exacerbating their vulnerabilities and challenges.

	Wayanad	Meppadi	Wards 10,1 1, 12
Total No. of people with disabilities	23122	1036	61
PWD - Men	11310	473	12
PWD - Women	9474	455	20
PWD- Girls	1052	51	10
PWD - Boys	1256	57	11
TYPE OF DISABILITY			
Locomotor	6770	338	22
Audio	3230	131	7
Visual	3483	128	8
Autism	142	12	4
Down's Syndrome	99	7	2
Intellectually Challenged - Others	9398	420	18
Involved in income generating activities	3600	220	13
No. employed	460	26	3
Children going to school	700	58	12
Children in higher education	150	12	3

Table 17-4: *Pre-Disaster Context - PWD pollulation*

	Men	Women	Boys	Girls
Total number affected	12	20	11	10
Deceased	0	1	0	0
Missing	0	0	1	0
Hospitalized	1			
Relocated to camps	3	5	2	4
Relocated to relatives' homes	6	10	6	2
Moved to rented premises				2
Houses fully damaged	6	11	5	4
Houses partially damaged	3	6	3	4
Houses washed Away	1	2	2	1
Houses deemed unsafe	2	1	1	1
Loss of livelihoods	12	20	0	0
Loss of education days	0	0	30	30
Unable to continue education	0	0	5	5

Table 17-5 *Impact of Landslide on PWD Population*

7.10. Recovery and Rehabilitation

Educational Support:

To ensure the optimal development of children with disabilities, it is essential to provide specialized education tailored to their individual needs. This can be achieved through enrolment in a special school or by receiving individualized instruction from a qualified professional in a home-based or center-based setting.

An individualized educational program (IEP) is a proven approach to addressing the unique learning needs of children with disabilities. Educators can provide targeted support and accommodations to help these children reach their full potential by developing a personalised plan.

Family based disaster management plans:
Given Wayanad's vulnerability to natural disasters and the potential challenges in evacuating individuals with disabilities, it is imperative to develop family-based disaster management plans. These plans should identify safe spaces within the community and establish clear evacuation routes.

Particular attention should be paid to ensuring that individuals with disabilities receive timely and appropriate information regarding early warnings. Utilizing their preferred communication methods, such as sign language, is crucial for effective dissemination.

Pre-vocational and Vocational Training:
To ensure the long-term wellbeing and self-sufficiency of children with disabilities, it is essential to prioritize their access to pre-vocational and vocational training. This will equip them with the necessary skills to participate meaningfully in the workforce and contribute to society.

Livelihood:
Ornamental fish farming, cattle rearing, poultry farming, dryer unit operation, petty shops, latex-based item production, and tailoring units are viable options that individuals with disabilities can explore.These activities offer opportunities for self-employment and income generation.

To enhance their skills and employability, it is recommended that adults with disabilities receive specialized training in these areas.

Skilling:
Individuals strongly preferred acquiring skills to ensure a sustainable livelihood. This skill development should not be limited to technical aspects but should also encompass financial literacy, small business planning and management, and an understanding of government options and linkages.

Provision for Assistive Devices:
As per the Micro-Plan survey conducted by the district administration, the need for assistive devices was reported as lost in the aftermath of the disaster. Therefore, it is recommended that the replacement of lost assistive devices be prioritized, and that a comprehensive assessment be conducted to identify the additional needs of individuals with disabilities within the affected area.

Assessing and Updating disability status:
During field visits, it was observed that some individuals with disabilities had experienced a decline in their health status but were unable to access necessary medical care for assessment. To address this issue, it is recommended that a medical camp be organized to evaluate their current health conditions and update their disability status.

Nutritional Support:
Individuals with disabilities, particularly children, are at a heightened risk of experiencing dietary deficiencies. Conducting a comprehensive nutrition assessment and providing specialized nutrition packages when necessary is essential to ensure their wellbeing.

Availability of Documents:
Many individuals with disabilities have lost their essential documents due to the disaster, hindering their ability to access government schemes and other beneficial programs. The government has taken swift action to facilitate the replacement of these documents.However, it is crucial to ensure that all individuals with disabilities have received the necessary documentation to access the care and support they require. This includes verifying that they have been reissued with all relevant documents that may have been lost during the disaster.

Ensuring Psychosocial wellbeing:
The psychological and social wellbeing of individuals with disabilities affected by the disaster must be prioritized.

Providing long-term psychological support to these individuals is essential for their recovery and overall wellbeing.

Availability of Govt. Schemes and Services:
To facilitate a comprehensive recovery process, it is essential to connect affected individuals with disabilities to relevant government schemes, such as the Pariraksha Scheme for Persons with Disabilities.

These programs can provide vital support and resources for rehabilitation and recovery.

Shock responsive social protection scheme:
The disaster may have significantly impacted the livelihoods of families with members who have disabilities. In such circumstances, individuals with disabilities may be hesitant to place additional burdens on their families by requesting specialized medicines or nutrition support. To provide essential support during this challenging time, it is recommended that an additional financial assistance scheme, known as Shock Responsive Social Protection, be implemented. This supplementary support, in addition to the INR 1,600 monthly disability pension, will help alleviate financial hardships and ensure that individuals with disabilities have the necessary resources to meet their needs.

Particulars	Unit/ Frequency	Unit Cost	Amount (in crores)
Support for Assistive Devices (Lump sum)	1	600000	0.06
Medical Camp for updating disability status	2	25000	0.005
Nutritional Support (10 children for 3 months)	10	1000	0.003
Educational Support (15 children for 12 months)	15	6000	0.108
Skill Training for adults with disability	30	10000	0.03
Livelihood support for adults with disability	15	50000	0.075
Rent support for adults who have lost their livelihoods (6 months)	10	6000	0.036
Shock Responsive Social Protection Support (6 months)	60	1600	0.0576
Development of Family based Disaster Preparedness (lump sum)	1	75000	0.0075
Psychosocial Counselling (lump sum)	1	300000	0.03
Total			**0.4121**

Table 17-6 *Recovery and Reconstruction Estimate for Persons with Disability*

17.11. Social Inclusion and Women

Pre-disaster Context

The Meppadi Grama Panchayat has a population of 18,946 women and 18,230 men. According to the District Disaster Management Plan (DDMP), the female workforce in Wayanad constitutes only 26.8% of the total workforce, with a significant portion engaged in agricultural labour. This demographic profile is reflective of the women's workforce in Meppadi

17.12. Impact of Disaster on Women

The landslide had a devastating impact on women, accounting for 92 of the 231 fatalities. The widespread destruction of homes, land, and livelihoods has disproportionately affected women, leading to increased vulnerability.

The Micro-plan survey conducted by Kudumbashree in Wayanad, under the aegis of the district administration, identified 42 households comprised solely of women. These women have lost their close family members, including husbands, and are now left alone or with elderly or young dependents.

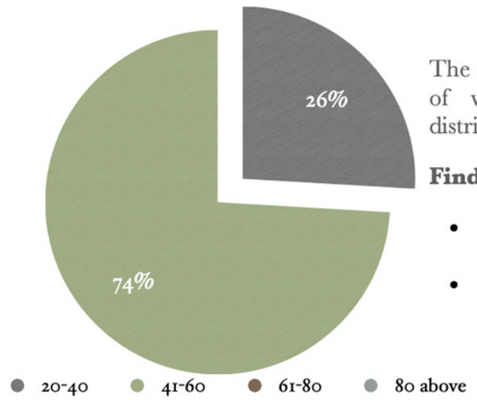
Previous estimates indicated that approximately 74% of these women-only households fell within the 41-60 age group. It is reasonable to assume that the increased number of identified households would follow a similar age distribution.

Most women-headed households in the affected region primarily depended on agricultural labour. Two of these women originally hailed from Karnataka. While some women have sought refuge with relatives, the majority have transitioned from relief camps to rented premises.

Given their reliance on agricultural labour or daily wages, most women-headed households are facing severe financial difficulties. The loss of their primary source of income has created a pressing need for immediate financial assistance. In the area over 50% of them

Age-Wise Distribution of Women-Headed Households in Wayanad

Age	Numbers
20-40	7
41-60	20
61-80	0
80 above	0



The table provides a breakdown of the number of women-headed households in Wayanad district, categorised by age group.

Findings:

- There are a total of 41 women-headed households.
- The majority of women-headed households are in the 41-60 age group, followed by the 20-40 age group. There are no women-headed households in the 61-80 or 80+ age groups.

were previously employed in agricultural labour or plantation work but have lost their primary source of income. Five affected women are currently undergoing treatment and require surgeries, further exacerbating their financial challenges.

The government has provided initial financial support of INR. 10,000 per family to alleviate immediate hardships. Additionally, relief kits and "Back-to-Home" kits, distributed through donors, CSRs, NGOs, IAGs, IAG GO-NGO and civil society organizations, have been instrumental in supporting this vulnerable group of women.

While the focus of this assessment has been on women-headed households, it is essential to acknowledge that there are other households where women have become the sole breadwinners due to the incapacitation of their male partners. The ongoing enumeration conducted by Kudumbashree will be instrumental in identifying these households and ensuring they receive the necessary support.

There are 62 Self-Help Groups (SHGs) in Meppadi, comprising 685 members. Many of the women interviewed were active participants in their local SHGs. These SHGs engage in thrift and credit-based activities, with outstanding internal loans amounting to INR 68.60 lakhs. Forty-nine SHGs have established loan linkages with three banks, with outstanding loan amounts totaling INR 1.76 Crs.

However, it is important to note that the data on loans obtained through private banks is currently unavailable. Due to the devastating impact of the disaster on their livelihoods, SHG members are facing significant challenges in repaying their loans. In one instance, a loan taken for house construction was rendered useless as the house was completely washed away. The SLBC has implemented a moratorium on loan repayments for a period of one year. Even repayments already taken during this month were returned to the disaster affected. However, this moratorium alone may not alleviate the financial burden on women-headed households, as interest continues to accrue during this period. To provide more comprehensive relief, it is recommended that the government consider taking over outstanding loans, both those obtained through nationalized banks and private banks. This would significantly reduce the financial burden on women-headed households, enabling them to focus on recovery and rebuilding their lives.

While the initial assessment focused on ***"Women-Only Households,"*** it is important to recognize that there may be other households where women have become the sole breadwinners due to the incapacitation of their male partners. To ensure comprehensive support, it is recommended that the support measures currently being provided to women-headed households be extended to all families where women have become the primary breadwinners due to the disaster. This will help address the specific needs and challenges these vulnerable households face.

Damages, Losses and Reconstruction

Damage assessment is covered in the Livelihoods and Housing Sector, while reconstruction is addressed within the Housing Sector.

17.13. Recovery

The recovery recommendations are categorized into Immediate and Mid-term Requirements.

Short-term Requirements

1. **Medical Care:** Five women require ongoing medical care and surgeries. During this period, they will need nursing assistance due to mobility restrictions.

2. **Housing Support:** As all their houses have been destroyed, these women require financial assistance for at least a year or until the completion of new housing construction.

3. **Safe Housing:** Safe housing arrangements must be provided for all 42 women-headed households.

4. **Gratuitous Relief:** Eligible women who have not been residing in relief camps can receive Gratuitous Relief (GR) as compensation for lost livelihoods. The Revised Items and Norms 2022-2026 of the Ministry of Home Affairs (MHA) for Assistance from NDRF and SDRF outline the eligibility criteria and guidelines for GR. Given that these women may not be able to resume their work in plantations or as daily wage earners for some time, they are eligible for a 45-day GR period at INR 346 per day. This

financial assistance will help alleviate their immediate economic hardships.

Note: The specific eligibility criteria and GR amounts may vary depending on the latest government guidelines and the specific context of the disaster. It is recommended to consult with relevant government agencies for the most up-to-date information.

5. **Immediate Activation of Widow Pension:** Women who lost their husbands in the disaster should be promptly enrolled in the Widow Pension Scheme, waiving the mandatory seven-year waiting period, especially if their husbands' bodies have not been identified.

6. **Child Support through kinship care support**: Preliminary assessments have identified approximately seven women who are the sole caregivers of young school-going children or toddlers. To support women who have become primary caregivers for young children, it is recommended that the government extend the Kinship Care Support program. This program currently provides INR 4,000 per month per child to orphans.

   However, it is anticipated that based on the ongoing enumeration, the number of women in this category may increase. It is essential to ensure that these women receive the same level of support as orphans, particularly considering the challenges they face in raising children alone. A 12-month period of Kinship Care Support would provide significant assistance to these women, enabling them to meet the needs of their children and facilitate their recovery from the disaster.

7. **Skilling:** While some older women may prefer to return to their previous work in estates or agriculture, others desire more stable employment opportunities. It is recommended that basic skill and aptitude profiling be done on these women to ensure the marketability of the skills taught.

   For example, three women have tailoring skills and have requested support for sewing machines and assistive resources. Similarly, other needs must be addressed to ensure their long-term economic stability.

8. **Income generation support:** Income generation support will have to be provided for all these women on a priority basis as they are the sole breadwinners of their families.

Medium- Term Requirement:

Health and Life Insurance: Given their role as the primary breadwinners for their families, it is strongly recommended that these women be assisted in obtaining family health and life insurance policies. This will provide crucial financial protection in the event of unforeseen circumstances, such as illness or death.

By ensuring adequate insurance coverage, these women can safeguard the wellbeing of their families and mitigate the potential financial hardships that may arise in the future.

17.14. Social Inclusion and Indigenous Communities

Despite Kerala's overall progress in human development, indigenous populations, comprising approximately 1.5% of the state's population, continue to face significant disparities in socioeconomic status, healthcare, and education. Their deep-rooted connection to the natural environment, particularly the hilly regions, renders them particularly vulnerable to the impacts of climate change-induced disasters such as landslides.

Wayanad, a district recognized as an aspirational region within Kerala, exemplifies indigenous communities' challenges. The district's unique geographical features and environmental conditions exacerbate the impact of disasters on these vulnerable populations.

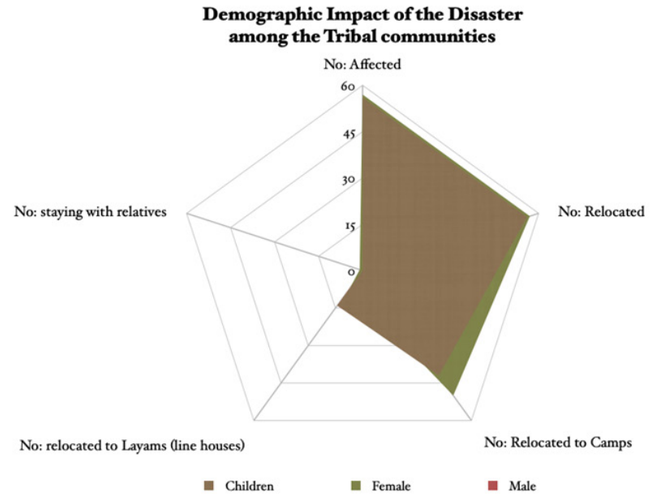
Activities	Unit Cost	Number of Units	Total (in crores)
Medical Support	3,00,000	5	0.15
Rent for 1 year	6000	42	0.3024
Gratuitous Relief (GR) as per MHA norms for 1 month (based on MGNREGS wages)	346	42	0.065394
Kinship Support for 12 months	4000	30	0.144
Skilling	25000	30	0.075
Income Generation Support	25000	25	0.0625
Family Health and Life Insurance	6000	42	0.0162
Total			**0.815494**

Table 17-7 *Recovery and Reconstruction Estimate for Women centric Initiatives*

	MEPPADI	WARDS 10, 11, 12
No. of settlements	71	5
Tribal communities	Paniya, Kuruma, Kattunaykka, Kurichya, Urali	Paniya
Number of families	1012	42
Total population – men	1680	54
Total population – women	1770	46
Total population – boys	456	21
Total population – girls	530	35
Livelihoods – men	Forest dwellers, agriculture, plantation workers, and daily wage workers like MGNREGS, masons, construction workers, government officers, skilled workers, etc.	Forest dwellers, agriculture, plantation workers, and daily wage workers like MGNREGS, masons, construction workers, etc.
Livelihoods - women	Forest Dwellers, Agriculture, Plantation Workers, and daily wage workers like masons, construction workers, etc.	Forest Dwellers, Agriculture, Plantation Workers, and daily wage workers like masons, construction workers, etc.
Literacy – men	-	Approximately 5%
Literacy - women	-	Approximately 3%
No. Of people with disabilities- men	5	1
No. Of people with disabilities - women	4	2
Bedridden- men	9	0
Bedridden- women	10	1
[Source: Scheduled Tribes Development Department (STDD)]		

Table 17-8 *Pre-Disaster Context- Meppadi Panchayat and Landslide Affected Areas*

17.15. Impact



Demographic Details	Children	Female	Male
No: Affected	56	57	54
No: Relocated	56	57	54
No: Relocated to Camps	42	50	40
No: relocated to Layams (line houses)	14	7	14
No: staying with relatives	0	1	0

SOURCE: SCHEDULED TRIBES DEVELOPMENT DEPARTMENT (STDD)

The provided radar chart compares the impact of the disaster on different demographic groups: children, females, and males. The chart uses a scale from 0 to 100 to represent the impact, with higher scores indicating a greater impact.

Analysis:

- Children: Children were significantly impacted by the disaster, with high scores across all categories. This suggests that children were particularly vulnerable and suffered greatly during the event.
- Females: While the impact on females was also substantial, it was slightly lower than that on children. This may indicate that women faced different challenges and vulnerabilities compared to children.
- Males: Males experienced the lowest impact among the three demographic groups. This could be due to various factors, such as differences in roles, responsibilities, and access to resources.

Table 17-9 *Livelihood Profile of the affected Communities*

Locality/ Habitation	Major Livelihood
Punchirimattam	Men: Agriculture and allied activities, agriculture labour, forest dwellers and plantation labourers Women: Agriculture and allied, forest dwellers and plantation labourers
Errattukundu	Men: Forest dwellers, agriculture and allied activities, plantation labourers
Puthiya Village	Men: Forest dwellers, agriculture and allied activities, plantation labour Women: MGNREGA, agriculture and allied and plantation workers
Ambedkar Unnathi	Men: Agriculture and allied activities, plantation works, masons Women: MGNREGA
Athichuvad Unnathi	Men: Agriculture and allied activities, plantation works, masons Women: MGNREGA

17.16. Housing

Despite avoiding landslides, floodwaters have impacted tribal settlements, but their location in high-risk landslide zones requires permanent relocation. Temporary housing with relatives or in rented premises is necessary until safer options become available.

The resumption of plantation work, except in Harrison and Malayalam, has been delayed, causing financial hardship for many tribal families.

17.17. Response

The Scheduled Tribes Development Department (STDD), with assistance from the District Disaster Management Authority (DDMA), led the emergency relief response. Supported by Aapda Mitra, Civil Defence units, and local emergency response teams, they conducted rescue operations and established temporary shelters for displaced residents. To address the specific needs of vulnerable populations, including those at risk of malnutrition, pregnant women, and individuals with sickle cell anemia, specialized healthcare programs were implemented. These initiatives ensured access to essential medical services. Furthermore, psycho-social support was prioritized, with early intervention programs launched by commited social workers and the ST Promoter from the Tribal Extension office in Kalpetta.

Damages:

Although the houses and infrastructure of the affected communities remained physically intact, their location within a designated danger zone posed a significant risk. As a result, a decision was made to relocate these communities to a safer location.

Reconstruction:

All five settlements will be relocated to a safer area. The costs associated with this reconstruction project will be covered under the Housing Sector budget.

Relocation Principles:

The tribal communities, hailing from five distinct Unnathis[13] within Kerala, each possess unique cultural practices. While a consolidated relocation to a single site is an option, a cluster model, wherein each Unnathi retains its distinct identity, is recommended. Each cluster should incorporate space for the respective tribal deity and worship area to preserve traditional practices. A Common Community Centre can serve as a platform for fostering community support and interaction among the five Unnathis.

The design and planning of both the habitation and individual houses must be collaborative, involving input from each cluster. Women's active participation is crucial to ensure that traditional gender-specific needs are considered and respected.

17.18. Recovery

The recovery and rehabilitation of the Indigenous community must prioritize cultural sensitivity, inclusivity, and long-term resilience. The process should safeguard their cultural heritage and practices while ensuring economic stability, access to forest land, education, healthcare, and basic services.

i. Facilitation of Swift relocation based on the norms of entitlements as per the Forest Rights Act:

Expedite the relocation of tribal communities in accordance with the Forest Rights Act's entitlement norms. Given their reliance on Non-Timber Forest Products (NTFPs) for sustenance, this initiative will mitigate the displacement impacts of the landslide and preserve their traditional livelihoods and cultural practices.

ii. Temporary Housing Assistance:

While most affected families currently reside with relatives or in Layams[14], a significant number of individuals have preferred independent living arrangements. To facilitate this, we can provide assistance in identifying suitable rental housing options during the interim period, prior to the availability of permanent housing solutions.

iii. Community specific Habitation Planning:

Given the challenge of Wayanad's fragile ecosystem and the community's specific requirements regarding access to forest land for their sustenance, the government is contemplating moving Tribals from all five affected settlements to one area. In such an eventuality, a cluster-based approach may be followed, with each cluster dedicated to one settlement, as each settlement's lifestyles and practices may differ. Each cluster should also have space for their tribal deity and worship.

In order to ensure the new houses are designed according to their practices, beliefs, and choices, it is best that the design and planning be done along with the community, including the women, before finalizing.

iv. Ensuring the continuity of education by providing access to schools:

With the extensive school damages and subsequent decision to integrate the children into schools in Meppadi, there were concerns voiced, by the parents, on access to Meppadi for children who are too young to travel by bus to such long distances. While the boys were willing to stay in the Tribal Hostels, the girls wanted to commute from home. The "Vidya Vahini" initiative of the Tribal Department, to transport children to school may be reactivated to ensure continued education for the tribal children, especially the young children and girls.

v. Bridge Courses:

The extensive damage to schools and their subsequent utilization as relief camps has substan-

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[13] *Unnathi meaning Colony (The Kerala government has issued a directive to replace the terms 'colony', 'sanketham', and 'ooru' with the more dignified terms 'nagar', 'unnathi', or 'prakrithi' when referring to Scheduled Caste and Scheduled Tribe settlements in all official records).*

[14] *A layam is a dwelling for plantation workers.*

Activity	Unit Cost	Number of Units	Total (in crores)
Temporary housing facilities for 12 months	6000	47	0.3384
Gratuitous Relief (GR) as per MHA norms for 1 month (based on MGNREGS wages)	692	47	0.097572
Ensuring access to schools- Vidya Vahini - 3 routes for 10 months	60000	10	0.06
Bridge Course (cost of one Educator for 10 months)	20000	10	0.02
Skill Development	5000	15	0.0075
Livelihood Support	25,000	15	0.0375
Setting up Community Learning Centers	500000	1	0.05
Community - centric Disaster Management Plan	10000	5	0.005
Study to understand Indigenous Knowledge in Disaster Management and Risk Reduction			0.03
Total			**0.645972**

Table 17-10 *Recovery and Reconstruction Estimate for Tribes*

tially disrupted the educational process, leading to a loss of at least one month of education days. In the absence of educated caregivers at home, many children may experience difficulties in catching up with their peers. Supplementary educational programs, such as bridge courses, are recommended to mitigate this challenge. Community volunteers can play a crucial role in delivering these programs in collaboration with the Sarva Shiksha Abhiyan.

vi. Provision of Gratuitous Relief (GR) as per norms:

According to the Revised Items and Norms 2022-2026 of the Ministry of Home Affairs for Assistance from the National Disaster Relief Fund (NDRF) and State Disaster Relief Fund (SDRF), Gratuitous Relief (GR) can be provided as compensation for lost livelihoods, following MGNREGA guidelines for up to 30 days for those not residing in relief camps. Since the tribal communities may be unable to resume their work in plantations or as daily wage earners for a period, they are eligible for and should receive GR for 30 days at a rate of INR. 346 per day for two adults per family.

vii. Establish Sustainable Livelihood Programs incorporating indigenous and climate-smart Agricultural Practices:

Support the implementation of sustainable livelihood programs that integrate indigenous agricultural practices that can promote food security and economic stability. The Paniya community possesses unique knowledge of local ecosystems and traditional farming techniques that are well-adapted to the region's climatic conditions. By supporting these practices, rehabilitation efforts can promote biodiversity, improve soil health, and increase resilience to climate change.

viii. Skill Development Opportunities based on the Needs of the Paniya Community:

This can include vocational training in sustainable agriculture, eco-tourism, and handicrafts, which not only preserve cultural heritage but also create income-generating opportunities.

ix. Set up Community Learning Centers:

Establish community learning centers to provide a space for education, cultural exchange, and community gatherings.

x. Assess and address health concerns like Malnutrition and Sickle Cell Anemia:

Although not explicitly raised as an issue, it is advisable to assess the potential impact of the disaster on the health of children, pregnant women and lactating mothers, the elderly, and individuals with disabilities within the community. This assessment will enable the identification of targeted interventions, if necessary.

xi. Integration of Indigenous Knowledge into DRR Systems, Region-Specific Early Warnings, and Participatory Disaster Management Plans:

The Scheduled Tribes Development Department in Wayanad has developed participatory Disaster Management Plans for the community last year. This may be revisited and learnings from the current disaster incorporated ensuring indigenous and experiential knowledge into disaster management plans and risk reduction systems, making them culturally relevant and context-specific.

xii. Study on Tribal Resilience:

A notable observation from the 2018 Kerala Floods and the recent landslides is the resilience of traditional tribal housing and communities to both landslides and floodwaters. These communities appear to possess an innate understanding of safe routes and locations. A comprehensive study exploring their preparedness and resilience could provide valuable insights. By investigating their traditional knowledge, risk assessment capabilities, coping mechanisms, community planning, and preparedness, we can develop more context-specific disaster management and disaster risk reduction plans tailored to the needs of these communities.

17.19. Social Inclusion and Transgender

Pre-Disaster Context

Kerala stands out as one of the few Indian states with a comprehensive Transgender Policy, which has significantly increased the visibility of this previously marginalized group. According to official records, Wayanad district has 23 registered transgender individuals under the Department of Social Justice. These registered

individuals are eligible for various welfare and development schemes offered by the department.

However, community members report a much larger transgender population in Wayanad, estimating around 120 individuals. This population can be categorized into three groups:

i. Those who have openly declared their gender identity and are registered with the department.

ii. Those who have declared their identity but remain unregistered, and

iii. Those who have not yet disclosed their identity publicly.

Those who have openly declared their gender identity typically live independently or with others from the transgender community.

17.20. Impact

Of the registered transgender individuals, only one has been directly affected by the landslides. Fortunately, the person is safe and has temporarily relocated for livelihood reasons. Informal reports suggest that a more significant number of transgender individuals, who have chosen to remain anonymous, may have been indirectly impacted by the floods. The decline in tourism and public events following the disaster has had a cascading effect on the transgender community, many of whom work in the hospitality and service sectors. However, due to difficulties in reaching these individuals, the extent of the impact on unregistered transgender persons remains uncertain.

Damages & Losses: No damages or losses have been reported among the registered members of the transgender community.

Reconstruction: Given the absence of reported damages, reconstruction efforts are unnecessary.

17.21. Recovery

While the transgender community has achieved official recognition, they remain highly vulnerable due to limited access to financial and social support mechanisms, particularly for those living independently. Prioritizing support mechanisms to mitigate their risks is crucial. The recommended strategies focus on enhancing preparedness.

a. Enhancing their acceptance:

Despite success stories like acquiring a commercial pilot's license, lack of acceptance at the societal level has been the bane of this community. Greater visibility in social spaces will go a long way in enhancing their acceptance.

b. Community Support Mechanisms:

Given their historical experiences of intolerance, building trust and confidence through sustained support is essential.

c. Community-Driven Rehabilitation:

Provide comprehensive support to strengthen community groups, regardless of registration status. Leverage their existing networks to disseminate information and development support, similar to approaches for people with critical medical requirements. This can facilitate mainstream integration while preserving anonymity and ensuring access to disaster-related information, early warnings, relief materials, and entitlements.

d. Alternative Livelihoods:

Encourage and support the transition into alternative livelihoods, such as beauty services, modeling, acting, and even aviation. Many transgender individuals have successfully ventured into these fields, challenging traditional stereotypes. Government initiatives like entrusting a canteen to a transgender self-help group and employing transgender individuals in the Metro are positive steps. While some of these initiatives may have faced challenges, persistent efforts are crucial to provide sustainable livelihood opportunities.

e. Skill Development:

Motivate transgender individuals to acquire skills that provide better opportunities in safe environments. Training programs should be developed in consultation with the community.

f. Insurance Packages:

Design and promote tailored insurance packages for the transgender community. State and district officials should take the lead in developing accessible insurance options.

g. Inclusive DRR Strategy:

Mainstreaming and sensitizing the Kerala State Disaster Management Authority's initiative on transgender-inclusive DRR.

h. Risk Reduction through Risk Transfer:

The transgender community lacks adequate health and life insurance coverage. Additionally, their small-scale businesses may not be protected by risk transfer mechanisms. Developing tailored insurance schemes, either group or individual-based, is crucial to address these vulnerabilities.

i. Activating Call Centre:

Given the public disclosure of their identities, transgender individuals may experience heightened vulnerability and face challenges in accessing government assistance during disaster relief efforts. To ensure their specific needs are met, a dedicated helpline at the Social Justice Department can provide essential support and facilitate access to necessary resources.

j. Gender Sensitive services and facilities:

Disasters can create vulnerable situations for many, but transgender individuals often face unique challenges during these times. Due to existing societal biases and inadequate facilities, transgender individuals are more likely to experience discrimination, exclusion, and even violence in emergency settings. Ensuring gender-sensitive facilities and services during disasters is essential to creating safe and inclusive environments.

Sl. No.	Activity	Total (in crores)
1	Setting up and strengthening a Trans-gender Society (Secretariat with two transgender staff @ 15,000/ month for two years, office rent @ INR. 5000/)	0.216
2	Skill Building 50@30,000 per person	0.15
3	IEC includes Government Schemes for health and corrective surgery	0.03
4	DRR Training	0.015
	TOTAL	**0.411**

Table 17-11 *Recovery and Reconstruction Estimates for Transgender Centric Initiatives*

Here are key ways to support transgender individuals through disaster preparedness, response, and recovery efforts:

Inclusive Shelter Facilities

- Gender-Neutral and Private Spaces
- Safe Sanitation Facilities
- Clear Policies and Staff Training

Access to Health & Medical Services

- Gender-Affirming Health Services
- Mental Health and Psychosocial Support

Privacy & Dignity in Distribution of Relief Supplies

- Discreet Distribution of Essential Items
- Inclusive Documentation Practices

Economic & Livelihood Recovery Support

- Employment Support for Transgender Individuals
- Access to Cash Assistance Programs

Engagement of Transgender Community Leaders in Disaster Planning & Recovery

- Inclusion in Planning and Response
- Community-Based Feedback Mechanisms

Anti-Discrimination Policies & Training for Staff and Volunteers

- Comprehensive Sensitivity Training
- Clear Anti-Discrimination Policies

Legal Support & Access to Documentation

- Assistance with Identification and Documentation Needs
- Protection of Transgender Rights in Disaster Policy

Awareness Campaigns & Community Support

- Promote Inclusive (usage of wordings) Messaging
- Empowering Transgender Individuals in Recovery Role

Special efforts must be initiated to design and develop such risk transfer mechanisms through group or individual insurance schemes for people from this community.

17.22. Social Inclusion and Migrant Workers

A study on 'In-migration, Informal Employment and Urbanisation in Kerala', sponsored by the State Planning Board (Evaluation Division) and released in August this year, has found that the state, which had an estimated 31.4 lakh migrants from other states during 2017-18, will have a migrant population between 45.7 lakh and 47.9 lakh by 2025 and 55.9 lakh and 59.7 lakh by 2030 as per the current rate of immigration.

In 8 years, migrant workers will equal one-sixth of Kerala's population (newindianexpress.com) *- December 29 2021*

Pre-Disaster Context

Wayanad district, heavily reliant on agriculture and tourism, employs a significant number of migrant workers across various sectors, including plantations, hospitality, construction, and others. Migrants constitute approximately 1.2% of the district's workforce. While systems for migrant registration exist, their implementation has been limited, hindering efforts to accurately estimate the number of migrants potentially affected by the disaster.

17.23. Post-Disaster Government Response

The government implemented several essential interventions to support migrant workers impacted by the landslides. The Local Self Government (LSG) organised dignified burial rites for deceased individuals. Furthermore, arrangements were made to repatriate 88 affected migrant workers to Madhya Pradesh, providing necessary assistance when returning to natives.

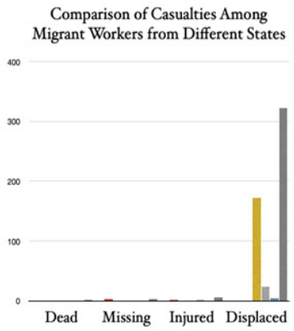
To address the diverse needs of the migrant community, the district administration established a multilingual information center. This center served as a valuable resource, offering crucial information and support in multiple languages, ensuring accessibility for all affected individuals.

Impact of landslide on Migrant workers

Classification	Dead	Missing	Injured	Displaced
Assam	0	0	0	56
Bihar	1	3	2	13
Jharkand	0	0	1	54
MP	0	0	0	173
Nepal	1	0	2	23
UP	0	0	1	4
Total	2	3	6	323

The table provides a breakdown of the impact of landslides on migrant workers from different states.

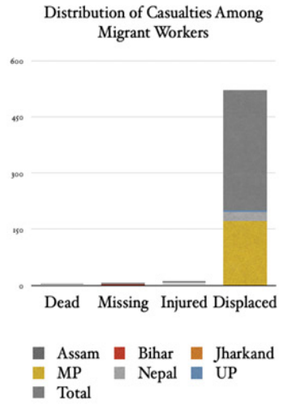
- Nepal has suffered the highest number of casualties, with a significant number of dead and missing individuals.
- UP has also experienced a substantial number of casualties, primarily due to the high number of injured individuals.
- While the number of casualties from other states is lower, it is still significant, highlighting the widespread impact of the landslides.
- The landslides have had a devastating impact on migrant workers, resulting in a large number of displacement.



The graph illustrates the distribution of casualties

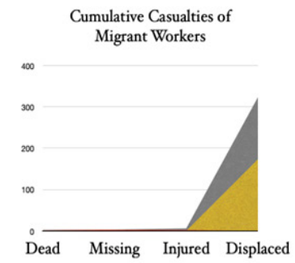
- Nepal has suffered the highest overall casualties, primarily due to a significant number of displaced individuals.
- Uttar Pradesh (UP) has also been heavily affected, with a substantial number of displaced individuals and missing persons.
- Other states, such as Assam, Bihar, and Jharkhand, have experienced lower levels of casualties.
- Overall, the graph underscores the devastating impact of the landslides on migrant workers, particularly in terms of displacement.

SOURCE: DISTRICT LABOUR DEPARTMENT



The chart illustrates the distribution of casualties among migrant workers from different states.

- Nepal has suffered the most significant impact, primarily due to a high number of displaced individuals.
- Uttar Pradesh (UP) has also been heavily affected, with a substantial number of displaced individuals and missing persons.
- Other states, such as Assam, Bihar, and Jharkhand, have experienced lower levels of casualties.



The graph depicts the cumulative number of casualties among migrant workers.

- There is a significant increase in casualties primarily due to displacement.
- While the number of dead, missing, and injured individuals remains relatively low, the cumulative impact of displacement has been substantial

Data Limitations:

Due to the informal nature of many migrant workers' living arrangements, accurately determining the number of individuals affected by the landslides has been challenging. While the West Bengal Labour Minister reported 242 stranded migrant labourers from that state, the state could establish contact with only 155 of them, and data from other states remains incomplete. Unaccounted Casualties: The lack of credible data on missing migrant workers not only prevents families from receiving rightful compensation but also hinders the issuance of essential legal documents like death certificates. With the return of some migrant families, information on missing individuals from their workplaces or living arrangements may be lost.

With many accommodations for the migrant workforce, known in the local parlance as 'Paadi', reportedly washed away, the toll of migrant victims is likely to be high. The plantation sector primarily engages Adivasi families from the central tribal belt, such as Jharkhand, Chhattisgarh, and Madhya Pradesh. The hospitality sector, with many resorts operational in the affected areas, on the other hand, depends mainly on migrants from the northeast, Darjeeling in West Bengal and even Nepal. Migrants from Assam, West Bengal and Bihar were also there in sizeable numbers.

- Excerpt from thehindu.com August 2 2024

Research and Development (R&D):

The Centre for Development Science (CDS) in Thiruvananthapuram has conducted seven rounds of the Kerala Migration Study (KMS), with the most recent study completed in 2018. To obtain updated data, it is recommended that another round of the study be conducted immediately in the affected areas.

Housing Challenges:

While some migrant workers have employer-provided accommodations, others reside in rented premises, often sharing with others. The landslides and floods have displaced these individuals, forcing them to seek shelter in relief camps. However, finding affordable housing will be challenging until their livelihoods stabilize.

Economic Impact:

Historically, migrant workers in Wayanad primarily engaged in plantation activities. With the growing popularity of Wayanad as a tourist destination, many have transitioned into the hospitality and service sectors. The landslides and their impact on these industries will significantly affect the livelihoods of a large number of migrant workers.

Mental Health:

The trauma of the landslides, coupled with limited social support systems, has led to fear and helplessness among migrant workers, prompting some to return to their home states. Those who remain continue to grapple with these emotional challenges.

Document Replacement:

While special camps were organized to assist individuals in replacing lost documents, have to ensure efforts were made to reach out to migrant workers who may have also lost their essential documents.

Lack of access to timely Information:

Despite many migrant workers acquiring a basic proficiency in the Malayalam language, language barriers remain a significant challenge for those who are not fluent in reading, writing, or speaking the language. As the primary medium of communication and information dissemination is Malayalam, migrant workers residing in relief camps may encounter difficulties comprehending and accessing available resources. While the efforts of volunteers and the district administration are commendable, mainstreaming language inclusivity in disseminating timely information is imperative.

17.24. Recovery Recommendations

The following recommendations are based on immediate and medium-term needs:

Immediate Requirements

Provision of Gratuitous Relief (GR) as per norms:
In accordance with the Revised Items and Norms 2022-2026 of the Ministry of Home Affairs for Assistance from the National Disaster Relief Fund (NDRF) and State Disaster Relief Fund (SDRF), Gratuitous Relief (GR) can be provided as compensation for lost livelihoods, following MGNREGA guidelines for up to 30 days for those not residing in relief camps. Eligible migrant workers should receive GR for 30 days at a rate of INR. 346 per day for two adults per family.

Rental Support:
Displaced migrant workers should be included in the government's rent provision scheme.

Data Assessment and Tracking:
A dedicated team or collaboration with the Centre for Development Studies (CDS) in Thiruvananthapuram should be established to assess the number of migrants in the affected areas and track their current status.

Registration and Documentation:
Facilitate the registration of migrant labourers and provide temporary identification documents to access relief services.

Legal Aid and Advocacy:
Offer legal assistance to help migrant workers claim their rights and benefits during and after the disaster

Health Monitoring:
Given the congested living conditions and potential for disease outbreaks, conduct regular health check-ups, focusing on infectious diseases, malnutrition, and mental health issues.
Information Dissemination: Utilize multiple channels to disseminate timely information about relief services, health advisories, and legal rights in languages understood by the migrant population.

Activity	Unit	Cost per Unit	Total (in crores)
Urgent updation of data	1	100000	0.01
Rental support for 4 months	100	6000	0.24
Gratuitous Relief (GR) as per MHA norms for 1 month (based on MGNREGS wages)	100	346	0.1038
Psychosocial Counseling			0.005
Help Desk (one multi-lingual staff at INR. 25,000/ pm for 6 months)	1	25000	0.015
Legal Aid Desk (@25,000/pm for 3 months)	1	25000	0.0025
Health Camps	4	20000	0.008
Multi-lingual IEC material for orienting on disaster preparedness			0.025
Developing multi-lingual Early Warning Systems			0.05
Total			**0.4593**

Table 17-12 *Recovery and Reconstruction Estimates of Migrants*

Multilingual Help Desk:
A multilingual help desk should be set up in Meppadi Grama Panchayat to support and guide affected migrant workers.

Medium Term

Community Engagement:
Foster collaborative relationships with migrant communities to understand their unique needs and concerns comprehensively. This engagement should extend to their active participation in the planning and implementation of relief measures.

Disaster Preparedness:
Equip migrant labourers with the knowledge and skills to build resilience against future disasters through targeted disaster preparedness and risk reduction training.

Educational Continuity:
Ensure that children of migrant workers have uninterrupted access to education, either by attending local schools or enrolling in temporary learning centres.

Childcare Support:
Provide essential childcare services to support working migrant parents, safeguarding the wellbeing of their children. While some children may already be enrolled in local Anganwadi's, additional efforts should be made to integrate children from affected groups into regional and temporary Anganwadi centres.

Government Development Scheme Access:
Assist migrant workers in navigating and benefiting from government-sponsored schemes explicitly designed for migrant workers, such as the Health Insurance Scheme and housing schemes.

17.25. Social Inclusion and Extreme Poor Households

Kerala has consistently demonstrated a resolute commitment to addressing the challenges faced by its most vulnerable population. The Extreme Poverty Eradication Program (EPEP) is one such initiative to this commitment, with the goal of eradicating extreme poverty from the state. State-led studies have unequivocally identified a significant portion of the extremely poor population as belonging to vulnerable groups. This necessitates the implementation of inclusive interventions to ensure their wellbeing.

A research study[15] conducted by the Centre for Socio-Economic and Environmental Studies (CSES) with the support of the Government of Kerala on extreme poverty underscores the intricate synergy of factors that can exacerbate poverty, particularly in the context of natural disasters. The study examines the intersectional poverty traps faced by vulnerable communities, demonstrating how exposure to disasters along with other factors can amplify existing socio-economic challenges.

Ward	Number of Households	Tribal Households	Economic Vulnerability	Social Vulnerability	Health and Nutrition Needs	Lack of Access to Services
10	7	2	High	High	High	High
11	3	0	Medium	Medium	Medium	Medium
12	4	0	High	High	High	Medium
[Source: Meppadi Grama Panchayat]						

Table 17-13 *Situation Analysis of Extreme Poor in the Affected Area*

[15] *S.G, Athul., Ajith Kumar, N., and Sunaina, Parvathy [2023]. "Beneath the Surface of Deprivation: Understanding Extreme Poverty in Rural Kerala." Centre for Socio-economic and Environmental Studies.*

Through a comprehensive analysis of case studies from disaster-affected communities, the report explains in detail how natural disasters can serve as catalysts for deepening poverty. The study identifies various shock factors, such as displacement, loss of livelihoods, and infrastructure damage, that can intensify existing vulnerabilities. When combined with underlying issues like inadequate social support, disability, and financial constraints, these stressors can push vulnerable households into a cycle of extreme poverty and hardship.

In keeping with the commitment to leave no one behind, the Kerala State Disaster Management Authority has recognized the plight of extreme poor households in disaster-affected regions of Meppadi. Therefore, have incorporated these vulnerable groups into its comprehensive cross-sectoral analysis, demonstrating a proactive approach to addressing their specific needs and challenges.

The regions of Mundakkai and Chooralmala have been severely impacted by recent disasters, highlighting the extreme vulnerabilities of their impoverished populations. These extreme poor households face a compounded burden of poverty, marginalization, and other vulnerabilities such as disability, tribal identity, elderly status, or gender. Their marginalized position in society exacerbates the challenges they face, making them particularly vulnerable to the impacts of disasters.

Lack/Limited of Access to Services

- The extreme poor face significant barriers in accessing essential services, such as education, healthcare, and social welfare programs.
- Many households lack the resources to pay for these services, while others may be unaware of their availability or how to access them.

17.26. Specific Needs of The Population

- **Housing:** The extreme poor require affordable and sustainable housing solutions that are adapted to their specific needs. Those who can't stay at houses should be institutionalized.
- **Psychosocial Support:** Providing mental health and psycho-social support is crucial for helping individuals cope with the trauma of disasters and rebuild their lives since most of them are living isolated and vulnerable which increases their chance to affect their mental health. Long term rehabilitation and handholding are needed. (Two of the Paniya community members have multiple vulnerabilities)
- **Education and Skill Development:** Enhancing the education and skills of the extreme poor or members of their families can help them build resilience against future disasters, scale up their accessibility to the mainstream and increase their social status and social capital.

17.27. Targeted Interventions and incorporating DRR

- **Targeted Support Programs:** Develop tailored relief packages that address the specific needs of the extreme poor, including immediate needs such as food, shelter, and healthcare, as well as longer-term support for rebuilding livelihoods and improving resilience to region specifics.
- **Inclusive Disaster Risk Reduction (DRR) Strategies:** Ensure that DRR plans are inclusive and accessible to marginalized communities, incorporating the needs of the extreme poor into disaster preparedness, response, and recovery efforts at the local level.
- **Capacity Building:** Empower the extreme poor to participate actively in disaster preparedness and recovery processes through training programs, community-based initiatives, and support for local organizations working with marginalized populations.

- **Customized Rehabilitation Micro-Plans:** Develop rehabilitation plans that consider the specific needs of the extreme poor, including housing solutions, psycho-social support, and education and skill development programs.

17.28. MICRO-PLANS FOR "BUILD BACK BETTER"

1. Community-Based Disaster Risk Reduction (CBDRR):

- **Participatory Vulnerability Assessment:** Conduct community-led assessments to identify specific risks and vulnerabilities faced by the extreme poor.
- **Early Warning Systems:** Establish inclusive local early warning systems for those who are illiterate and have digital gaps, including community-based watchpoints and communication channels.
- **Disaster Preparedness Plans:** Develop community-specific disaster preparedness plans that outline evacuation routes, emergency shelters, and response procedures that are accessible to all.

2. Sustainable Livelihoods

- **Skill Development:** Provide training programs in agriculture, fisheries, handicrafts, and other sustainable livelihood options.
- **Microfinance:** Facilitate access to microfinance schemes to support income-generating activities.
- **Disaster-Resistant Infrastructure:** Promote the construction of disaster-resistant climate-adaptive housing, infrastructure and climate-innovative agricultural practices.

3. Social Protection and Welfare

- **Targeted Social Assistance:** Implement targeted social assistance programs, such as conditional cash transfers and food security initiatives like the Community kitchen if needed.
- **Health and Nutrition:** Improve access to healthcare, nutrition education, health and life insurance, UDID cards, vaccination and essential health services.
- **Education:** Enhance educational opportunities for children, particularly those from extreme-poor marginalized communities.

4. Capacity Building

- **Community Training:** Conduct training programs on DRR, disaster response, and leadership development.
- **Community Organizations:** Support the formation and strengthening of local community organizations.
- **Knowledge Sharing:** Facilitate knowledge sharing and best practices among communities.

Special housing facility is not needed for them because it's a multi-layered vulnerability. But special consideration needed to be provided.



FINANCE & INSURANCE

18



Finance & Insurance

As in any disaster, the financial implications have a multiplier effect, affecting the directly impacted population and connected businesses and services. This section of the Post Disaster Needs Assessment looks at the impact of the landslide on banking services and mechanisms for disaster risk finance.

18.1. Banking

Various banks operate approximately 50 to 60 branches across Wayanad. This includes a mix of public sector, private, and cooperative banks, ensuring widespread coverage of banking services. Of the total impacted population, 905 individuals have availed of 1947 loans for different requirements including housing, education, agriculture etc. The distribution of loans across major categories is as in ***Table 18-1***.

The major segment, forming 28% of the total, availed gold loans. Agriculture loans came next at 20% and 11% borrowed personal loans, as per ***Figure 18-1***. In total, loans worth INR 18.83 Cr. were availed from 17 banks as shown in ***Table 18-2***.

The cost estimates of physical damages to banks are accounted for in the section on Public Buildings and Commercial infrastructure. The outstanding loan amounts can be considered as losses incurred by these banks due to the landslide.

Table 18-1 *Loan Categories*

Sl. No.	Loan Category	Outstanding Amount
1	Agriculture	3,78,20,927.65
2	Education	22,31,587.11
3	Gold	5,34,23,236.72
4	Housing	1,26,32,635.80
5	MSME	97,37,715.06
6	Others	4,44,56,447.78
7	Vehicle loan	53,91,171.59
8	Personal loan	1,99,74,614.19
9	SHG	26,83,132
Total		**18,83,51,467.90**

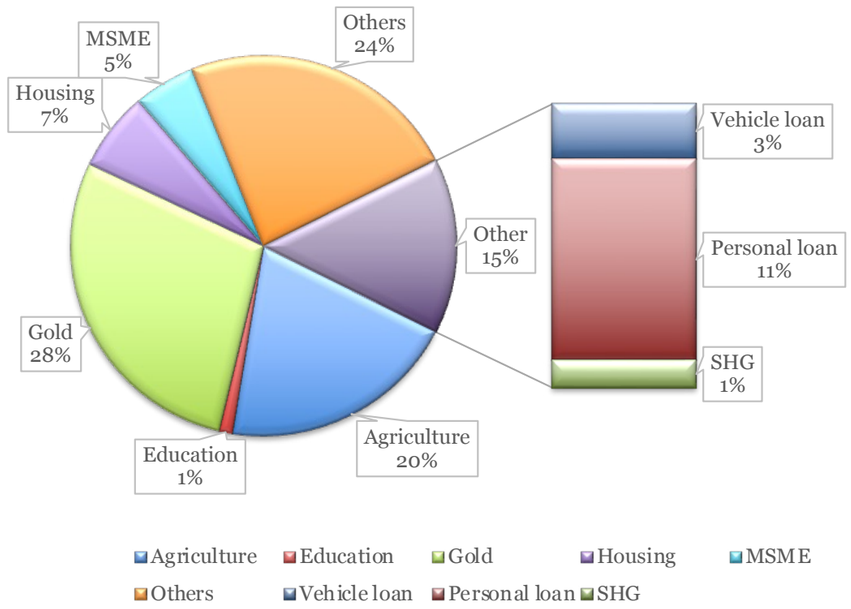


Figure 18-1 *Distribution of loan categories*

Table 18-2 *Outstanding loan amounts across banks*

Sl. No	Name of Bank	Outstanding Amount	No. of Loans
1	Bank of Baroda	51,54,361.98	29
2	CBI	1,14,78,842.81	61
3	Canara Bank	20,89,991.00	37
4	ESAF	32,04,958.00	59
5	Federal Bank	26,64,154.00	20
6	Indian Bank	20,11,793.00	4
7	IndusInd Bank	26,08,162.59	18
8	Kerala Bank	6,41,03,776.25	561
9	KGB	6,95,74,950.27	939
10	Kalpetta Cooperative Urban Society	7,35,164.00	11
11	Meppadi Urban Bank	26,862.00	1
12	PNB	55,19,532.00	32
13	SBI	59,10,201.00	43
14	The South Indian Bank Ltd	78,61,349.00	97
15	Trikkaipetta SCB	1,94,302.00	4
16	Union Bank of India	5,51,898.00	3
17	Vythiri PCARDB	46,61,170.00	28
Total		**18,83,51,467.90**	**1947**

Category	Number	Income Loss
Loans	1947	18.835
Grand Total		**18.835**

Table 18-3 *Loss Estimate*

Table 18-4 *Recovery Cost Estimate*

Recovery Measures	Cost Estimate (Cr. INR)	Timeline	Implementing Agency
Disaster Risk Finance – Setting up Seed Fund for Risk Transfer Mechanism	50	Long-term	GoK, KSDMA
Grand Total	**50**		

18.2. Disaster Risk Finance

With the advent of climate crises, the number of disasters is expected to increase exponentially in the coming years. This creates additional financial stresses in an already precarious condition. As of 2024, Kerala's debt stands at INR 4.29 lakh crores, with one of the highest debt-to-GDP ratios in the country at 36.6% as per RBI. The steadily rising revenue deficit, fiscal deficits and declining share of the divisible pool by the 15th Financial Commission have weakened the state's financial health. Therefore, reliance on ex-post financing of emergency response, rehabilitation, and reconstruction from public budgets would be challenging and ineffective, requiring alternative innovative ways to transfer the risk and finance the response, as well as rehabilitation and reconstruction of the areas hit by these natural catastrophes.

In this regard, it is essential to set up reinforcement measures such as Disaster Risk Finance (DRF) to prepare for calamities without hindering the growth and development of communities. DRF is crucial in mitigating the economic impacts of natural disasters, such as floods, landslides etc. by ensuring the flow of funds to facilitate reconstruction and recovery initiatives. Governments worldwide have been working closely with the Insurers, Reinsurers and other Agencies to develop various disaster risk financing programs. The motivation for all these programs has mainly been to support the vulnerable segment of society, support the Government's efforts around reconstruction and rehabilitation, and reduce the financial burden.

Risk transfer driven by insurance and reinsurance solutions has played a significant role in various government's endeavours to bridge the gap between relief and growth efforts. Therefore, it is imperative to support a state such as Kerala, a multi-hazard-prone region, in setting up a mechanism for risk transfer considering the characteristics of the population, susceptibility to various hazards, and range and pricing mechanism of the insurance coverage. In this regard, it is proposed to invest INR 50 Crs., as a seed fund to support the State's mission for disaster risk transfer [***Table 18-4***].

The interest rate on the fund is expected to be 8%, compounding monthly over 5 years. At this rate, the principal amount is projected to grow by 48.984%.



INTANGIBLE
IMPACTS

19



Intangible Impacts

19.1. Assessing Intangible Assets Loss

In the immediate aftermath of natural disasters, the focus is often on tangible losses—physical destruction of homes, infrastructure, and lives. However, it is equally important to recognize that the intersection between human capital and natural resources significantly influences the recovery trajectory and long-term growth. While tangible assets are the primary focus of disaster response efforts, intangible assets, though challenging to quantify, are indispensable for a community's resilience and well-being. These intangible assets, often overlooked in traditional damage assessments, encompass a diverse range of cultural, social, and environmental elements that are essential for sustainable recovery.

To ensure a comprehensive and effective recovery process, it is imperative to integrate the assessment of intangible asset losses into Post-Disaster Needs Assessments (PDNA). Given Meppadi Grama Panchayats unique socio-environmental fabric, this analysis focuses on seven significant intangible assets that the devastating landslide has profoundly impacted.

Intangible Assets: Socio-Environmental Loss Framework for PDNA

The socio-environmental loss framework for PDNAs aims to bridge the gap between conventional assessments and the deeper, long-term impacts on communities and ecosystems. It emphasizes the importance of recognizing how social, cultural, and environmental dimensions contribute to community resilience, and how their disruption can hinder recovery.

The framework is divided into two broad categories:
socio-fabric loss and environmental-fabric loss.

19.2. Socio-Fabric Loss

Social fabric loss refers to the erosion of the intricate network of social, cultural, and religious institutions, relationships, and values that bind communities together, impacting their collective identity and resilience. This breakdown disrupts the communal identity, traditions, social cohesion, and spiritual connections that are essential for the psychological well-being and cultural continuity of individuals within the community. When disasters disrupt the social fabric, communities experience emotional displacement, weakened social ties, and the erosion of cultural practices. These consequences can have long-lasting effects on communal identity and social stability.

1. Assessing the Loss of Religious Identities

In Kerala, religious identities and institutions serve as the bedrock of local communities, deeply intertwined with their history and upholding their socio-cultural fabric. The state's enduring tradition of communal harmony is exemplified by the exemplary humanitarian support offered by religious institutions, particularly during disasters. This underscores the profound social values they embody, which transcend sectarian differences. Emotional attachments, identity formation, and place-based values are always linked to the religious institutions in the locality. This also determines the societal peace and harmony and the community's way of living.

The religious sentiments of the affected areas are detailed in news pages such as *"The families here shared a beautiful neighbourly bond, sharing their happiness and woes. Moreover, the village often came together to celebrate the temple and church festivals"* exhibits harmony and connectedness to various religious institutions.

The landslide triggered the loss and damage of such belongingness which are immeasurable. A write up on the total destruction of Siva temple at Chooralmala says, *"The river carried away the priest and the idol. Only the banyan tree remains as a mute witness to disasters."*.

This was a temple where pooja was held twice a day. And many people including tourists used to visit. The joint secretary of the temple committee revealed that the priest was told to move to a safer place when it rained the day before. The priest was adamant about staying back. He has lived in the house next to the temple for the past ten years. In the morning, it was learned that the river had swept away everything including the temple. The priest was a native of Pandalur in Tamil Nadu and immigrated to this place to perform the rites.

"Only the river could be seen by the time we reached the temple. Two days later, the head of the priest was found nearby. The body part had washed away. When the family came to know about what happened, they returned home with his head" - reported to be said by the joint secretary.

Munavurul Islam Jum'a Masjid at Mundakkai is another institution which was damaged during the landslide. The CSI church which is situated adjacent to the mosque shows the religious harmony among the local population. The famous Mariamman Kovil is also situated 500 m from the Masjid on the top of the hill.

These institutions mark the religious identity of the community and the landslide happened to have a devastating impact on these identities which is immeasurable. During the disposal of the dead bodies these three institutions and the workforce were in action for burial or cremation. The devastating landslides in Wayanad inflicted severe damage on religious institutions, not only physically but also symbolically. These institutions, which served as the heart of the community, were more than just structures; they embodied the people's collective spirit and cultural identity. Their destruction symbolized a severing of the threads that weave the social fabric together.

Beyond the physical damage, the loss of these religious institutions represents a significant intangible loss. These places of worship, integral to the communal fabric, served as centers of spiritual solace, cultural expression, and social cohesion. Their destruction disrupted a shared history, spiritual belonging, and the very essence of community. Despite the tragedy, the community demonstrated resilience and solidarity, as evidenced by the collective efforts during the burial and cremation of the landslide victims. However, the irreplaceable loss of these sacred spaces underscores the profound socio-cultural void left in the community. The damage to such intangible assets highlights a critical dimension of disaster impacts that often goes unnoticed.

2. Loss of Indigenous (Tribal) Identities

Indigenous communities often depend highly on their ancestral lands for survival and cultural identity. When landslides or other disasters displace indigenous peoples, it disrupts their connection to land, tradition, and practices that have been passed down for generations.

In Meppadi, the displacement of tribal populations has significantly impacted their sense of belonging and identity, threatening the survival of their cultural practices and traditions. The Paniya is the only tribe dwelling in the landslide affected area, the Paniya community acting as the main workforce for the farming settlers has under gone cultural amalgamation. However, there are Paniya communities in different land pockets that are still forest dwellers and gatherers, although they have connections with the mainland population. Paniya community in the Meppadi – Mundakkai region are mostly forest dependent. Their belief system includes animistic and native spiritual activities, emphasizing their deep ties to nature and the environment. Thus, when the forest landscape is destroyed due to landslide, it shatters the belief system and identity of the community members apart from their livelihood.

This was evident from the interaction with the community members of the Erattukund tribal Unnnathi who were the survivors of the landslide. When the landslide occurred, they all escaped to the forest area in the stream's upper reaches while others moved to the downhill roads.

"The change in the behaviour of stream and its erratic movements were fearful on the day before landslide which was a warning" one of the community members said.

They also have a cultural connection with various places across the landscape, particularly in the forest transformed by the disaster. Their intimacy with the animals, including their household dogs, also showed their connectedness with the landscape. For the labourers dwelling in the 'Padi' – the group houses the landslide, which was the loss of their sense of security and harmony, which they had previously experienced. The displacement of the Paniya people represents an intangible loss that cannot be easily measured but is felt profoundly within the community. Their fears about safety, especially for their women, in new resettlement areas reflect their loss of security and the trust they once had in their environment.

As seen in the aftermath of the Meppadi landslide, the loss of socio-fabric reflects the profound, intangible impacts of disasters that extend far beyond physical destruction. For communities like the Paniya tribe, their connection to the land, culture, and spiritual practices forms the very foundation of their identity and way of life. The resulting loss is immeasurable and irreplaceable when disasters disrupt these vital ties. This erosion of socio-fabric undermines cultural continuity, emotional resilience, a sense of security, and community cohesion.
In this context, socio-fabric loss should be recognized as an intangible but essential component of post-disaster recovery. Addressing it is as critical as restoring physical infrastructure. If such losses are ignored, the recovery process remains incomplete, leaving lasting scars on the community's collective psyche.

3. Fertility Loss of Women

In the aftermath of disasters, stress, trauma, and health complications can lead to a decline in women's reproductive health. This loss can be deeply traumatic for both the individuals affected and the broader community, as it impacts future generations and societal structure.

Fertility loss linked to disasters are established by various studies mostly executed in the developed countries. It is not surprising to hear this linkage since childbearing is one of the most consequential choices people make depending on the place and the socioeconomic backgrounds. Global climate crisis linked extreme climate events consequents disasters have been affecting people physically as well as psychologically. This also has implications towards behaviours and human deeds.

The global research on the linkage between disasters and fertility loss heightened and became notable from 2019 to 2022 (Ahmed *et.al.* 2024). Several countries with substantial populations and histories of disasters, such as

Figure 19-1 *First day of FPAI Medical Camp as part of the project*



India and China, have a relatively low research representation on this linkage.

Fertility loss is predominantly dependent on physical factors like contraceptive use, postponement of childbearing, reductions in completed family size, or abortion, as well as psychological factors (e.g. fear of health risks). Some of the studies also considered physiological mechanisms, such as those preventing successful delivery (e.g. miscarriage), reproductive age mortality and preterm births (Lee *et.al.* 2023). These factors combine with the behavioural and psychological factors in a post disaster scenario may result in fertility loss. Various disasters' increasing frequencies, severity, and impact pose significant concerns for human fertility. Disasters can, directly and indirectly, affect reproductive health through factors such as malnutrition, reproductive tract infections, limited access to healthcare, psychological stress, and economic hardship. Disasters have varying effects on fertility rates, with some studies indicate a decline linked to socioeconomic changes and restricted healthcare access and others indicating increase due to absence of reproductive health care services and unavailability of contraceptives (Ahmed *et.al.* 2025).

The characteristics of risk associated with each disaster can result in the consideration of different mechanisms of fertility loss. Disasters affecting the physical conditions have different fertility loss manifestations when compared to disease outbreaks and other human made disasters. Physical disasters were postulated to drive fertility change mainly through behavioural mechanisms. When positive effects were found for physical disasters, they were more likely to occur in higher fertility contexts.

Uncertainty and sense of security plays an important role in fertility loss in the case of fertility loss linked to disasters. Fertility declined more in areas already vulnerable to the risk of droughts, suggesting that continuing uncertainty from disasters could be a contributing factor to the observed fertility decline in response to disasters. In the case of post short-duration disasters such as floods, earthquakes, tropical cyclones etc, the average change in fertility was either unclear or non-substantial (Lee *et.al* 2023).

Negative effects of disasters on fertility loss were most commonly reported between 0 and 12 months after the disaster, especially at 0 (i.e. at the onset) and 9 months after the disaster. Nonetheless, both negative and positive effects were most commonly reported at 9–10 months from the disaster onset (Lee *et.al* 2023). Studies in India have shown reverse causality in the relationship between standard of living of a household and fertility or male birth rates. While standard of living may determine childbirth rates and the preference for sons over daughters, families with more children may become worse off as the per capita availability of resources is lower (Nandi *et.al* 2018).

Socioeconomic development strategies must comprehensively address the complex interplay between disasters and fertility rates. Understanding and addressing these interconnections is crucial for effective recovery and long-term well-being. Policymakers and researchers must consider these complexities when designing interventions to mitigate the diverse impacts of disasters on fertility patterns and behaviours.

Response

The Minimum Initial Service Package (MISP)[16] for Sexual and Reproductive Health (SRH) in crisis situations is a series of crucial, lifesaving activities required to respond to the SRH needs of affected populations at the onset of a humanitarian crisis. Given the utmost importance of these services, as part of the IAG GO-NGO Coordination responding to the landslide, with the approval of the District Administration and District Medical Administration, KSDMA has facilitated FPA India's[17] project titled "Meeting the Essential Sexual & Reproductive Health (SRH) Needs of Communities Affected by Landslides in Wayanad District, Kerala." The four-month project supports the response by delivering the Minimum Initial Service Package (MISP) for SRH services to the affected community and is overseen by the District RCH Officer of NHM.

In the recovery phase, considering the health and wellness of women affected by the landslide, similar programs and initiatives are to be initiated and implemented. These recovery programs will focus not only on immediate SRH needs but also on long-term wellness strategies, including women's health, maternal care, and access to essential health services. Continuous monitoring and capacity building for local health workers will be a key focus to ensure sustainability and resilience in the face of future crises.

19.3. Environmental Fabric Loss

Environmental fabric refers to the natural ecosystems and services that sustain human life and contribute to the ecological balance. Disasters like landslides disrupt these systems, leading to losses that have long-term implications for both human well-being and environmental health. Environmental-fabric loss refers to the degradation or destruction of natural landscapes and ecosystems, which provide both tangible and intangible benefits to a community. This encompasses the loss of biodiversity, aesthetic beauty, ecological networks, and the essential services that ecosystems offer, such as water regulation, soil fertility, and climate moderation. Environmental loss not only impacts livelihoods, particularly in communities dependent on natural resources, but also affects the emotional and cultural connections people have with the land. This loss can lead to a sense of ecological grief, as individuals mourn the destruction of their natural surroundings and the loss of the intangible benefits they provided.

1. Aesthetic Loss

Natural landscapes provide not only ecological functions but also hold immense aesthetic and cultural value. The beauty of the environment

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[16] *The MISP is developed by the Inter-Agency Working Group for Reproductive Health in Crisis (IAWG). UNFPA, in partnership with stakeholders, supports the implementation of the MISP to make sure that all affected populations have access to lifesaving SRH services. The key aims of the implementation are that there is no unmet need for family planning, no preventable maternal deaths and no gender-based violence (GBV) or harmful practices, even during humanitarian crises [https://www.unfpa.org/resources/minimum-initial-service-package-misp-srh-crisis-situations]*

[17] *Family Planning Association of India (FPA India) founded in 1949, is a national voluntary organization which pioneered the family planning movement in India. It is one of the founder Member Associations (MA) of the International Planned Parenthood Federation (IPPF), the world's foremost non-government provider and advocate of sexual and reproductive health and rights with 132 Member Associations working in a total of 164 countries.*

is deeply tied to a community's sense of place and overall well-being. In the case of Meppadi, the landslides drastically altered the landscape, stripping it of its scenic charm. This transformation has brought about both emotional and economic consequences, particularly in areas that heavily rely on tourism.

Aesthetic value refers to the sensory and intellectual experiences people derive from a place, influenced by both natural and built environments. In Meppadi, the aesthetic value was closely intertwined with the community's farming, culinary, water, energy, and marketing systems, along with various local policies. This altered landscape, once known for its cascading waterfalls, mist-covered mountains, and lush plantations, has lost much of its essence. Remnants of the area's glorious past—such as the old tea factory and sentinel rock—along with the mountain streams, waterfalls, and plunge pools in the Mundakkai and Chooralmala areas, contributed to the aesthetic charm of the region. The aesthetic value of Meppadi was also deeply connected to its environmental and socio-cultural fabric, helping to shape the community's identity and sense of belonging. As a biocultural asset, the natural beauty of the region instilled pride, well-being, and emotional ties among the local population. The intangible benefits associated with this beauty—tourism, community pride, and psychological rejuvenation—were invaluable. Numerous testimonials, Instagram stories, vlogs, and travelogues showcased the picturesque nature of the area, embedding it into the identities of both locals and visitors alike.

The region's growing population and its appeal as a tourism destination were also linked to its aesthetic value. The scenic beauty of Meppadi attracted people from all walks of life, fueling economic growth in the region.

The climatic features of the region further contributed to its aesthetic allure. This is reflected in descriptions from social media posts, news articles, and travelogues, such as "The mist that embraced the mountain slopes sometimes made Mundakkai extremely cold" or "An idyllic village nestled amid the beautiful mountains covered in blankets of mist." The mist-covered mountains created a picturesque landscape cherished by many.

The devastating landslide has irrevocably altered the once-idyllic landscape of Meppadi, erasing much of its aesthetic beauty. This loss, while immeasurable, extends far beyond the tangible realm, leaving a profound emotional and economic void within the community. The scenic elements that once attracted tourists and supported livelihoods have been swept away, leaving behind a stark reminder of the fragility of nature. While infrastructure can be rebuilt, restoring the aesthetic and emotional value of the place is a far more complex endeavor. This underscores the importance of integrating intangible assets into disaster recovery strategies. By considering the loss of aesthetic value, emotional well-being, and cultural identity, communities can work towards a more comprehensive and meaningful recovery.

2. Loss of Ecological Networks

Ecological networking system comprises of forests, rivers, biodiversity and other landscape factors are crucial for maintaining the environmental balance and also for the existence of the local human popu-lation by providing various ecosystem services and natural resources. The destruction of these networks during disasters leads to habitat fragmentation, loss of biodiversity, and disruptions in ecosystem ser-vices such as water purification and pollination.

In Meppadi, the landslides have severely impacted the local ecological networks, disrupting both natu-ral habitats and the livelihoods of communities that depend on these ecosystems. To site an example, in the case of Punchirimattam, the human settlement situated near to the crown of the landslide, the major water source for the households were the stream which is flowing nearby. This was evident by the pipes running to the stream from the adjacent houses. Indirect benefits such as organic matter sub-stitution as litter for the farming activities, the diverse niche of pollinators active in the area and the cane vegetation in the area rendered favourable environment for the people's livelihood.

3. Carbon Footprint of the New Township - Loss of Carbon Stock

As part of the recovery process, new settlements and infrastructure will need to be built. However, this often comes at the cost of increased carbon emissions and environmental degradation. The construction of new townships in Meppadi to house displaced populations is expected to have a significant carbon footprint, contributing to environmental degradation and climate change. This environmental loss is compounded by the displacement of communities from low-carbon, traditional ways of living to potentially higher-carbon, modern infrastructures.

Landslides can cause disruption in the process of Ecosystem carbon sequestration by eroding large vol-ume of soil along with vegetation (Liu et.al. 2022). Generally, the Soil carbon stock is three times more than that of the vegetation carbon stock and two times more than that of the Atmospheric carbon (Scharlemann et.al. 2014). A slight change in the soil carbon and vegetation carbon stocking capability can affect the amount of atmospheric carbon dioxide in a significant manner. Thus, the Meppadi landslide has caused the disruption of carbon stock which will definitely result in a considerable carbon loss which may have to be offset.

Further in-depth scientific investigation may be initiated exploring the ecosystem carbon stock change affecting the regional carbon recycling. As part of the recovery process, building new settlements and infrastructure is imminent. However, this often comes at the cost of increased carbon emissions and environmental degradation. The construc-tion of new townships in the region to house displaced population is expected to have a significant carbon footprint, contributing to environmental degradation and climate change. This environmental loss is compounded by the displacement of communities from low-carbon, traditional ways of living to potentially higher-carbon, modern infrastructures. This change may be offset by using Carbon neutral technology and processes and also devising suitable carbon stock development strategies. 'The con-structed wetland' suggested for the new township in the Forest and Environment section is one of the critical steps towards such activities.

19.4. Socio-Environmental Loss Framework for PDNA to Assess Intangible Loss

The proposed framework has been developed with careful consideration of the lessons learned from the Meppadi Landslide, taking into account the unique geographical positioning and socio-cultural context of the affected community. By identifying specific intangible losses, the framework aims to provide a more comprehensive understanding of their impact on the population and inform effective recovery strategies.

The Socio-Environmental Loss Framework for PDNA is a comprehensive assessment model designed to evaluate the intangible losses that arise from both social and environmental fabric destruction following a disaster. It focuses on identifying and addressing the psychological, emotional, cultural, and spiritual consequences of disasters that are often overlooked in traditional post-disaster recovery frameworks. The framework is structured to assess how the loss of cultural identity, social cohesion, ecological services, and aesthetic value impact the overall well-being of affected communities.

Conceptualizing the Socio-Environmental Fabric Loss

The conceptual framework presented in the diagram offers a structured approach to understanding the socio-environmental fabric loss resulting from the Meppadi landslide. While developed in the context of this specific event, the framework is designed for integration into Post-Disaster Needs Assessments (PDNA) to address the broader shocks and stressors generated by such disasters.

The key components of the framework are socio-fabric loss and environmental-fabric loss, which in turn generate psychological and emotional stressors within affected communities.

Both these dimensions experience direct damage and destruction during disasters, which lead to subsequent shocks and stressors. These shocks, both immediate and long-term, affect not only the physical environment but also the emotional, cultural, and economic well-being of the community.

19.5. Triggers of Shocks in Socio-Environmental Fabric Loss

In the aftermath of a disaster like the Meppadi landslide, shocks refer to the immediate, acute disruptions that impact the socio-environmental fabric of a community. These shocks arise from the direct physical destruction of lives, structures, landscapes, and institutions, which then ripple through the emotional, cultural, and

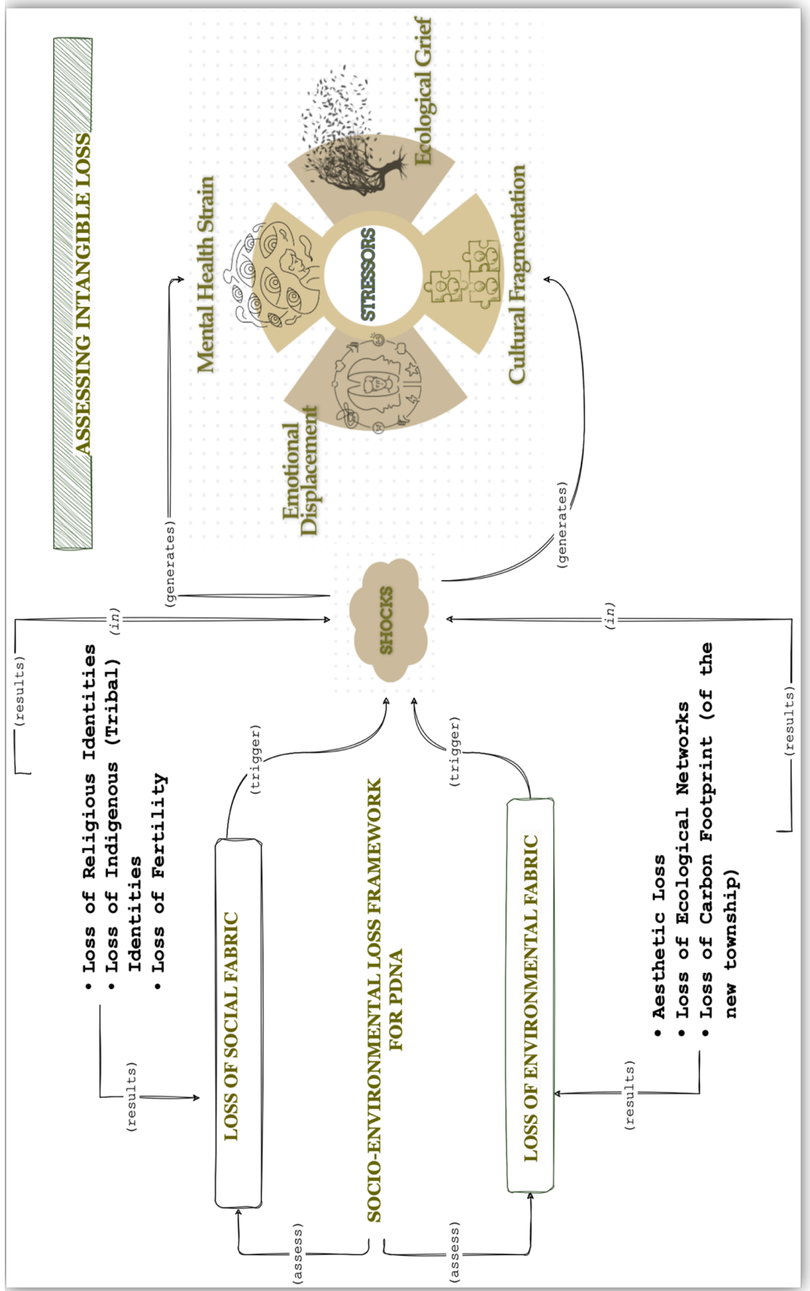

Figure 19-2 Socio-Environmental Loss Framework For PDNA

Note: The Socio-Environmental Loss Framework for PDNA is developed based on the learnings of intangible assets loss from Meppadi Landslide in Wayanad, Kerala, 2024 [Source: KSDMA]

economic dimensions of the community. Each shock disrupts the community's ability to function normally and initiates long-term stressors that challenge recovery.

The framework of shock triggers connects the immediate damage caused by the disaster to the social, cultural, and environmental losses that communities experience. This framework explains how these shocks manifest in both the socio-fabric and environmental domains, leading to subsequent cascading effects on the community's psychosocial well-being.

19.6. Stressors resulting from the Shocks

The framework highlights that these shocks generate long-term stressors, enduring challenges that communities face in the aftermath of the disaster. These stressors significantly impact the psychosocial and economic well-being of the population.

Key stressors include:

Emotional Displacement:
The loss of religious and cultural institutions disrupts the community's emotional and spiritual anchors, leading to mental health challenges like anxiety, depression, and a loss of identity.

Cultural Fragmentation:
The displacement of indigenous populations and the severing of ties with ancestral lands erode cultural cohesion, creating stress as communities navigate new environments while preserving their cultural identities.

Mental Health Strain:
The cumulative emotional, cultural, and economic shocks contribute to significant mental health challenges within the community. Fertility loss, social breakdown, and environmental destruction further exacerbate these strains.

Ecological Grief:
The destruction of natural landscapes and ecosystems leads to a profound sense of ecological grief. Communities not only lose their livelihoods but also their emotional connection to the land, resulting in long-term environmental stressors from rebuilding efforts.These stressors underscore the complex and multifaceted impacts of disasters, highlighting the need for comprehensive recovery strategies that address both tangible and intangible losses.

INTANGIBLE LOSS AND PSYCHOSOCIAL WELL-BEING – THE INTERSECTION

The intangible losses described in the framework, including the loss of cultural identity, spiritual connection, and aesthetic beauty, are inextricably linked to the psychosocial well-being of the community. These intangible elements, often overlooked in traditional disaster recovery efforts, are as crucial as physical infrastructure for a holistic recovery.The emotional and cultural connections that communities have with their religious institutions, ancestral lands, and natural landscapes are integral to their sense of well-being. The loss of these connections creates emotional displacement, cultural fragmentation, and ecological grief, which can lead to long-term mental health challenges.

The framework emphasizes the importance of focusing on cultural continuity in disaster recovery efforts. This includes supporting the reconstruction of religious and cultural institutions, re-establishing connections between indigenous communities and their lands, and fostering new cultural practices that help communities adapt to the changed environment. By addressing these intangible losses, recovery efforts can not only rebuild physical infrastructure but also restore the emotional, cultural, and psychological well-being of affected communities.

Summarized Recovery and Rehabilitation Plan for Intangible Assets

This recovery and rehabilitation plan integrates social and environmental fabric losses to address the intangible impacts of disasters, ensuring a holistic approach to disaster recovery.

Social Fabric Recovery Plan

Rebuild Religious and Cultural Institutions:
Reconstruct religious and cultural landmarks to restore community identity and emotional well-being.

Address Emotional Displacement:
Provide mental health support through counseling and community support groups to mitigate emotional stress.
Restore Tribal and Indigenous Identity:

Preserve indigenous traditions and land rights to maintain cultural continuity.

Promote Social Cohesion:
Organize community events and initiatives to rebuild trust, belonging, and social networks.

Environmental Fabric Recovery Plan

Ecological Restoration:
Focus on reforestation and restoring biodiversity, engaging communities in environmental rehabilitation.

Aesthetic and Scenic Restoration:
Rehabilitate damaged landscapes and enhance tourism through eco-friendly initiatives.

Rebuild Ecological Networks:
Restore water systems, soil fertility, and sustainable agricultural practices.

Sustainable Township Development:
Rebuild displaced communities using eco-friendly designs and sustainable technologies to reduce the carbon footprint.

Integrated Mental Health and Emotional Well-Being

Mental Health Support:
Provide psychological services addressing trauma and stress from socio-environmental losses.

Ecological Grief Counseling:
Help communities process the emotional impact of environmental destruction through collective healing and counseling.

Cultural Fragmentation:
Organize cultural renewal programs to preserve traditions, helping communities recover their sense of identity.

Monitoring and Evaluation

Track Tangible and Intangible Loss: Use surveys and community feedback to monitor recovery, with long-term evaluations of social and environmental impacts.

The plan focuses on rebuilding the physical infrastructure and affected communities' emotional, psychological, and cultural well-being. It ensures a resilient and sustainable recovery by integrating tangible and intangible loss recovery strategies, helping communities restore their identity, well-being, and ecological balance.

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VILANGAD LANDSLIDE

I

Vilangad Landslide – A Case Of Human Resilience

The Vilangad landslide of July 2024 serves as a stark reminder of the region's vulnerability to natural disasters, particularly landslides triggered by heavy monsoons. While past landslides in the area have resulted in significant damage, the timely evacuation and intervention of local residents and authorities helped to reduce the overall human impact of this event. However, the economic and infrastructural damage is severe, and the rehabilitation and recovery efforts are expected to take time. Government support through emergency funds, combined with reconstruction initiatives, is crucial for rebuilding the community and ensuring resilience against future natural disasters.

I.1. An Overview

Vilangad is a hilly village situated in the Vanimel Panchayat of Vadakara taluk in the northern part of Kozhikode district, Kerala. The village lies near the border of Wayanad and Kannur districts, and is close to the Kannavam Forest where three tribal settlements—Kuttalloor, Madacherry, and Panniyeri are located.

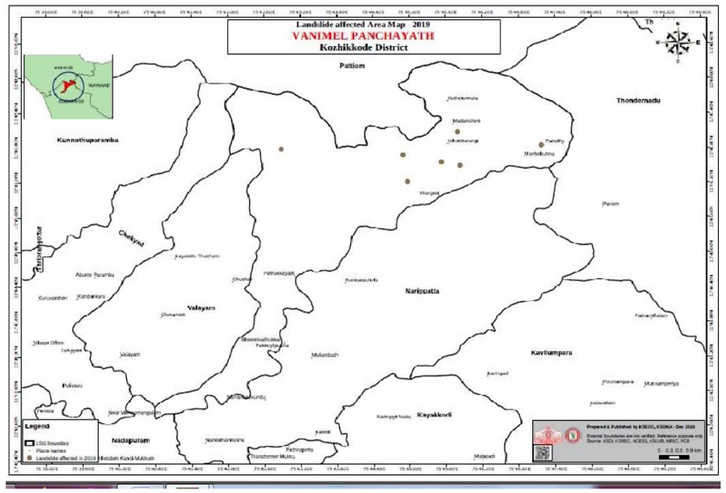
Vilangad and the surrounding regions have a history of landslides, with past events recorded in 1984, 2004, 2014, and 2019 [Figure I 1], each causing damage to property and, in some cases, resulting in loss of life. The area is recognized as being vulnerable to landslides, with the Geological Survey of India mapping parts of it as high and moderate hazard zones. The recurrence of landslides is exacerbated by steep slopes, heavy rains, and fragile geological conditions in the region.

Details of the July 30, 2024 Landslide

On July 30, 2024, Vilangad experienced a series of landslides caused by continuous heavy rainfall and strong winds. The primary landslide occurred in the Kunjom forest area of Wayanad at around 12:50 a.m. This triggered a sudden rise in the water level of the Vilangadu river, causing the accumulation of water and debris. Seven houses near the Panom KSEB microhydel project were isolated due to the blockage of water flow, creating severe disruptions in the area.

At 1:15 a.m., a second landslide occurred at Adichippara hill near Nanjacheeli. This landslide formed a deep gorge, further obstructing stream flow and causing significant damage to the

Figure I-1 *Landslide affected area Map of Vanimel Grama Panchayat - 2019*



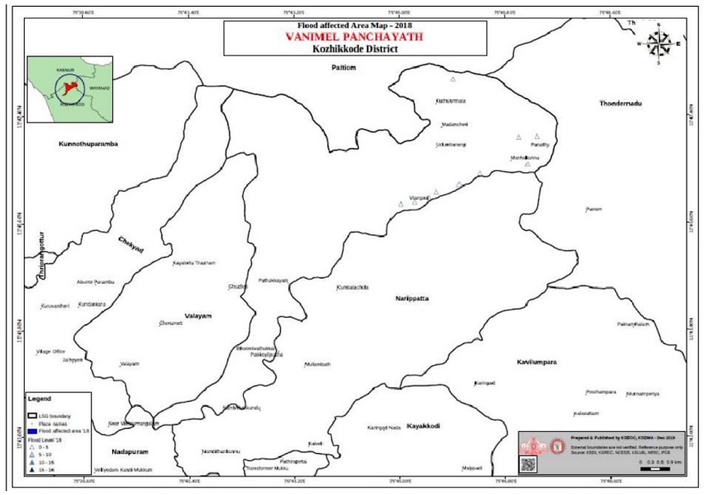


Figure I-2 *Flood affected area of Vanimel Grama Panchayat - 2018*

surrounding environment. The debris blocked critical water pathways, and over 70 landslides were reported in the nearby areas, including Panniyeri, Malayangadu, Kambilippara, Panom, and Kuttaloor.

The heavy rainfall and steep slope of the terrain contributed to the triggering of these landslides. The effects were extensive, though the relatively sparse population in these high-risk zones, coupled with the quick evacuation efforts, helped mitigate the human toll.However, one rescuer, Kalathinkal Mathew, tragically lost his life during the rescue operation.

Geodynamics of Vanimel Gram Panchayat

The topography of Vanimel Gram Panchayat can be classified into four distinct zones:

1. Highlands and Hills
2. Slope Areas
3. Valleys
4. Low Plains

Highlands and Hills

This region covers the majority of the Chitari, Palur, and Vilangad wards, along with portions of Karukulam, Kodiyura, Mampilakul, and Chelamuk wards. These areas, located at the foothills of the Kannavam Kunjom forest, are fertile zones where crops such as coconut, plantain, cardamom, rubber, black pepper, cashew, clove, and more are cultivated on a commercial scale. Additionally, crops like sorghum, yam, cassava, ginger, and turmeric are grown as intercrops.

The proximity to the forest provides a rich source of fertile soil, supporting the growth of a wide variety of medicinal plants and herbs, which are documented in the Gram Panchayat's Biodiversity Register. Some of the higher hill areas, however, are not suitable for cultivation due to their terrain. In these zones, small springs are common, though landslides are frequent. Wild trees and weeds dominate the landscape in these less cultivated areas.

The foothills are home to natural reservoirs such as Chakkarakund and Thonikayam, which, if scientifically developed, could be used for both drinking water and irrigation purposes. These highland valleys serve as critical watersheds for the region.

Slope Areas

Ten to forty percent of the land in wards like Wayalpeethika, Karukulam, Kommiyot, Pudukkudi, Velliyot, Parapupara, Kodiyura, Mambilakool, and Vanimel consists of sloped terrain. The farming techniques used in the highlands are also adopted here, though agricultural activities like vegetable farming are limited due to water scarcity.

Valleys

Valleys make up 10 to 20 percent of the region, including areas such as Karukulam, Nitumparam, Kommi, Pudukkudi, Velli, Varekkadav, Charappupara, Kodiyura, Mambilakool, Wayalpetika, and Vanimel wards. These valleys are considered highly suitable for habitation. Farming practices here mirror those of the rest of the panchayat, and drinking water schemes rely on tube wells and wells.

However, the region faces severe water shortages during the months of March, April, and May. Constructing permanent dams along the Vanimel River and implementing canal systems could alleviate this issue.

Low Plains

The low plains include the Kannukulam field area of Kommiyot ward, the field area of Varekkadav ward, and the areas surrounding the Mankav watershed. Much of the lowland has been reclaimed and converted into paddy fields, though some areas continue to grow rice and vegetables.

Crops like coconut, areca nut, banana, jackfruit, mango, cashew, nutmeg, clove, elephant yam, tapioca, ginger, and turmeric are commonly cultivated. During the monsoon, springs originating from the hilly areas at elevations between 250 and 600 feet above sea level flow unimpeded through the Vanimel River, serving as sources for drinking water and agriculture. However, these springs dry up during the summer, exacerbating the panchayat's water shortage. The soil in this area is rich in organic matter and consists of loamy soils, making it well-suited

for agriculture.

Environmental impacts, Land information, land use, soil, rock characteristics

The landslide happened at the top of Adichippara had caused a debris flow in the south east flank through locally named drainages/streams - Manjacheeli 1, Manjacheetti 2 and had fallen to the Vaniyampuzha at the foot. The strong debris flow consisting of boulders, soil, trees along with water had fallen to the valley region in the south eastern side of the hill which washed away the houses and shops in that area. The presence of large boulders, mud and soil as part of the debris flow had accumulated in this location. As per the landslide susceptibility zonation of KSDMA Adichippara- Manjachili area is in the medium hazard zone.

About one kilometer away from the location towards the east in the Koodippara – Vayad Unnathi area of the Thinur village, Narippatta Panchayat, the debris flow through the river destructed the Koodippara – Vayad Bridge. The debris had also reached and blocked different locations on the road from Vilangad – Mada – Panniyeri road which traverse from Vilangad Kurisadi to Udumbirangi hill. Out of these the debris flow which originated from the Kadamaankalari hillock of the Madanjeri region of the Vilangad Village, 9th ward of Vanimel Panchayat had flowed through the south western slopes via various outlets and streams adjacent to Madanjeri Unnathi (11 47' 17.07"N, 75 45' 37.94"E) and had dropped downstream.

This Unnathi consists 48 houses, one Anganwadi and a cultural center. Rocks, soil and mud had accumulated in this area in this region which is classified under medium landslide haz-ard zone of the KSDMA classification. Landslide had also happened in the Mochankayam, Panniyeri area in the 9th ward of Vanimel Panchayat. Out of these, the debris originated from Parambadimala located towards North and Kadamaankalari mala located towards East of Mochankayam (11°47'49.0492" N 75 o° 45' 23.9288"E situated about 1 km aerial distance from Madanjeri) had flowed in a V-shaped manner through the valleys and dropped in the river at the above-mentioned location and further flowed through the western flanks. This location also had rocks, mud, soil accumulation.

The debris flowed from the forests of Panniyerimala had reached the location 11°o 48' 1.7068" N 75°o 45" 28.2751" E Panniyeri site which is located 400 meters from the Mochankayam location through various outlets in the south easter flank. Panniyeri Unnathi which consists of 27 houses is situated in this above stated location. Tribal department promoter had stated that one house got totally damaged. This area has a topsoil of thickness about 7 meters. The debris flow consists of mud and soil had accumulated adjacent to the house in the location. This location and ad-jacent area is under the medium hazard zonation.

I.2. Impact of the Disaster

The aftermath of the Vilangad landslide saw severe destruction across multiple sectors, both public and private.

The total estimated damage was INR 98.10 crore, with impacts including:

Housing Damage

- 11 families lost their homes and land completely.
- 25 houses were completely destroyed, while 9 houses suffered partial damage.
- Several other buildings, including Anganwadi's, shops, and a library, were also destroyed

Infrastructure Damage

- A bridge at Vayad Colony near Naripatta Village was washed away.
- The drinking water pump house for the colony was destroyed, cutting off the water supply.
- Public assets such as roads, bridges, power lines, and water supply projects incurred damages worth Rs 158 crore.

Agricultural and Environmental Losses

- 1.24 hectares of homestead land was washed away.
- Approximately 250 acres of crops were damaged, causing long-term impacts on local agriculture.

Figure I-3 *Housing Damages in Vilangad*









Loss	House	Other buildings (Shops, Anganwadi, Library etc.)	Total
No. of people who have completely lost houses, buildings and land	11	7	18
No. of people who have completely lost houses and buildings	25	1	26
No. of people who have partially lost houses and buildings	9	1	10

Table I-1 *Individual losses to buildings and land*

Table I-2 *Total Land area loss of Housing*

Department	Loss	Land Area
Revenue	No. of people who have completely lost houses and land	1.24 ha
	No. of people who have completely lost houses	The existing land is uninhabitable- 5.2 ha
	No. of people who have partially lost houses	96 acres

Table I-3

Department	Loss	Land Area
Revenue	Loss of agricultural land	250 acres

- Debris flow obstructed natural waterways, contributing to environmental degradation.

Economic Losses

- Personal financial losses across various sectors were estimated at INR 58.81 crore.

1.3. Government Response

The immediate response to the disaster included financial aid and relief measures from both the State Disaster Response Fund (SDRF) and the Chief Minister's Distress Relief Fund (CMDRF).

Key measures included:

Emergency Financial Assistance

- As emergency relief, total of INR 10000/- for each family has been approved including those who stay at relief camps. Necessary steps are taken to provide INR. 5000/- from SDRF and the remaining INR. 5000/- from CMDRF.

Rehabilitation and Livelihood Support

- 30 families who lost their homes were relocated to rented accommodations and provided with INR 6000 per month as financial aid for living expenses.
- The families who lose their livelihood means shall be assisted with INR 300/- per person (adult) for 30 days as per SDRF norms. An additional of INR 300/- per person for 30 days shall be allowed for families with patients with severe ailment.
- Special provisions were made for bedridden patients and those undergoing long-term hospital treatments, who received INR 300 per day for one month.
- For those who living with the camp, assistance of INR 6000/- from CMDRF has been provided as rental price.
- Relief assistance of INR 50 lakh has been approved by Vadakara Tehsil (DCKK-D/9827/2024-F4 dated 02-09- 2024) for the Vilangad disaster relief from SDRF as emergency funding.
- As per the norms of SDRF INR 4,00,000/- and an additional of INR. 2,00,000/- from CMDRF has been approved for dependents of Kalathinkal Mathew (62), who died in the Vilangad landslide incident.

Figure I-4 *Damaged Bus Waiting Shed, Shops, roads & bridges (Page 523-524)*









Figure I-5 *Agricultural land and environment affected by Vilangad Landslide*









Compensation for the Deceased

The families of the deceased were provided INR 4 lakh from SDRF and INR 2 lakh from CMDRF.

Disaster Relief operations

- Letter dated 02/08/2024 has been sent from the office seeking report on damage to the concerned departments. With reference to that, report has been duly submitted by the departments.
- Report on damage caused by Vilangad landslide had been presented in the meeting on 07/08/2024, a meeting was held at the district collector's office with representative of various departments.
- On 07/08/2024, Vadakara Revenue division officer has been appointed as Nodal Officer to facilitate collection and storage of necessary items and overall coordination of relief camps.
- On 08/08/2024, meeting presided over by Revenue Minister was held in Vilangad Parish hall to present damage report by concerned departmental officials.
- Initial report on Vilangad landslide event has been prepared and submitted to the Principal Secretary on 09/08/2024.
- On 09/08/2024, letter had been submitted to the Principal Secretary with the details of new ration cards for free ration for families in affected area.
- On 11/08/2024, online meeting was conducted, presided by PWD to evaluate the progress of disaster relief.
- Order has been issued for the scientific inspection and preparation of report on affected area of Vilangad landslide event in Vanimel Grama panchayat on 02/08/2024. The team includes the District Geologist, District Soil Conservation Officer. District Hydrologist, Hazard Analyst and Assistant engineer (Vanimel GP).
- A letter has been submitted dated 13/08/2024 to Vadakara Tehsil to assess details such as plinth area, ownership, rental valuation for PWD to fix rent for the displaced people living in relief camps.
- Adalat had been conducted on 16/08/2024 at Parish Hall, Vilanagad for recovery of official documents. Officials from different department attended the Adalat and 105 certificates has recovered from 199 requests.
- Order dated 13/08/2024 had issued to constitute a technical team of 6 member (Geologist, Ward Member, LSGD Engineer, PWD Engineer and Village officer) to conduct Rapid Visual Screening (RVS) and submit report on the damages in the housing sector in Vilangad incident.

  For the timely submission of the report, team had requested for additional four 6-membered team for the assessment and the report was submitted on 16/08/2024.
- Drone mapping had conducted on the affected area by Dronimagination and based on that meeting was conducted to discuss the details collected from the survey map. A letter has been submitted to the Commissioner, Kerala State Disaster Management Authority requesting for LiDAR survey in the affected area.
- NIT Calicut and Kerala Startup Mission has conjointly informed the readiness to submit detailed report on LiDAR survey of Vilangad affected area, after its completion. Letter has been submitted to the Government for fund release for the same.

  Detailed report on the event will be submitted after the submission of report by NIT Calicut.

1.4. Reconstruction – recovery measures proposed

1. Loan waiver of the disaster affected population – Agriculture, education, personal loans may be waived or a moratorium may be declared on repayment.
2. Rehabilitation – of those who lost their houses and those who got evacuated due to the emergency situation has to be rehabilitated in a safe and secure place. It has to be noted that flat land for fair value which is not landslide susceptible is available for this purpose in Vanimel village.
3. Arch type bridges can be built in flood affected areas for withstanding the waterflow.
4. A permanent multi-storied, multipurpose relief shelter may be constructed in the region in the current circumstances of continuing disasters and the site where Vanimel community hall is situated is suitable for the purpose.
5. A LIDAR survey of the Vilangad landslide region may be conducted to assess the extent of landslide.
6. The people from Unnathis (tribal community housing) are willing to relocate themselves to flat plains. Rehabilitation strategy including this community may be planned which is highly recommended.

1.5. Damage, Loss and Recovery Estimates

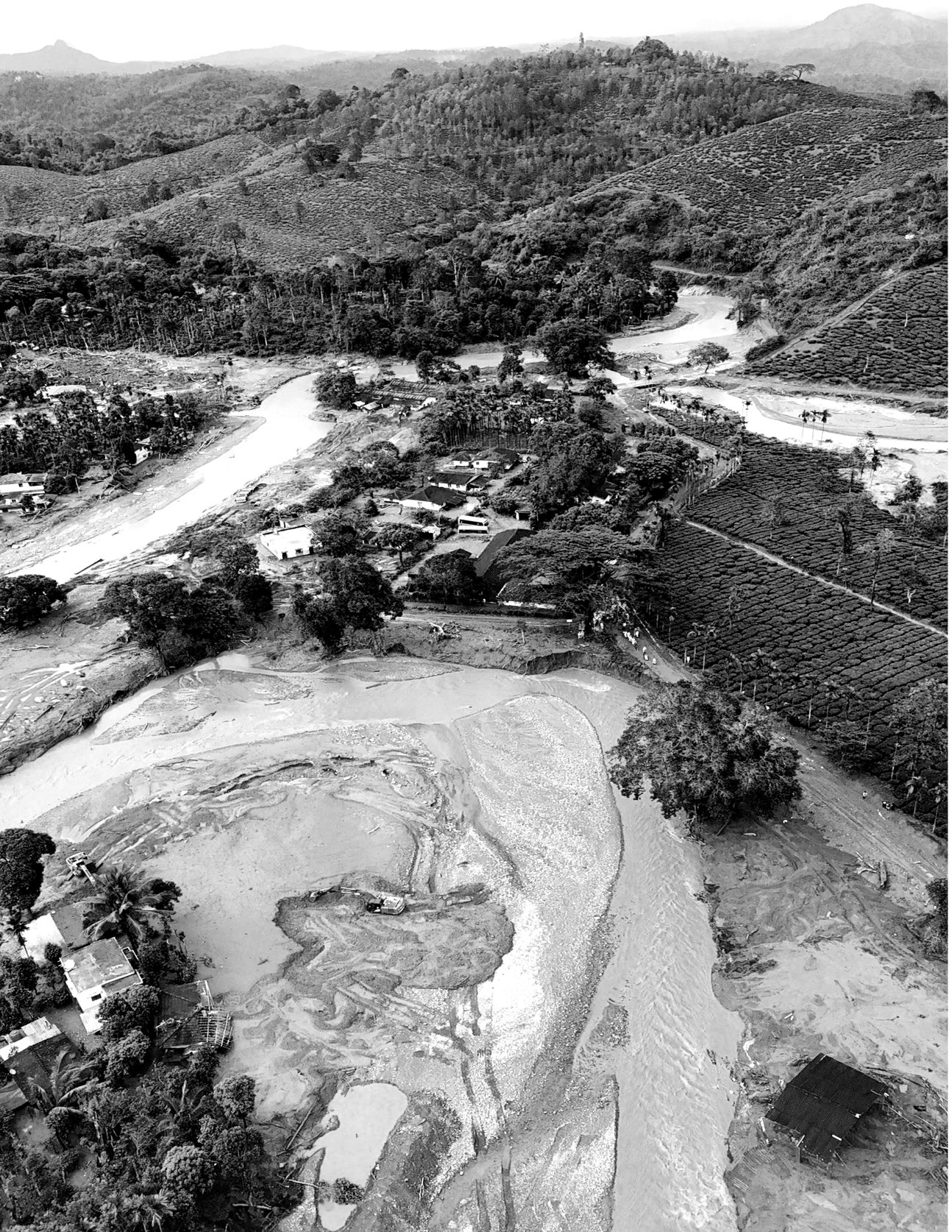
Table I-3 *Total Damage and Loss estimate*

Department	Damage and loss	Amount (Cr.)
Individual Damage and Loss		
Revenue	Loss of homestead land	3.62
	Houses (Completely)	8
	Houses (Partial)	1.25
	Agricultural land	25
	Shop (Complete)	1.75
	Inventory loss to shops	0.88
MVD	11 cars and 22 two wheelers	0.83
Kerala Gramin Bank Vilangad	Pending loan payments of 158 customers	4.64
Kerala Gramin Bank Vanimel	Pending loan payments of 10 customers	0.18
Kerala Bank Vanimel	Pending loan payments of 4 customers	0.07
Service Cooperative Bank	Pending loan payments of 42 customers	0.46
Federal Banks	Pending loan payments of 2 customers	0.066
IDBI	Pending loan payments of 1 customer	0.022
HDFC	Pending loan payments of 1 customer	0.01
Animal Husbandry	9 farmers in Vilangad - 0.1665, 1 farmer in Naripatta Panchayar - 0.001	0.1675
Dept. of Agriculture	225 farmers fully lost 103.2 ha in Vanimel 9, 10, 11	11.85
Grand Total		**58.7955**

Department Damage, Loss and Recovery Estimate		
PWD Bridges	1) Rebuilding side protection wall of Mudikkal bridge in Vanimel Panchayat - 6.50 lakhs 2) Rebuilding approach and service road of Urutti bridge - 90 lakhs 3) Restoring approach road (30 m), handrail and side protection walls (75 m) of Vilangad bridge - 35 lakhs Rebuilding bridge - 6 Cr. 4) Restoring approach road handrail (55 m) and side protection wall (55 m) of Valook Bridge - 30 lakhs Rebuilding Bridge - 3 Cr.	9.965
KRFB	(Damage and loss - 2 Cr.) Construction of Gabion Walls, GSB, WMM, BM and BC, New Bridge (Pulluvai - Thottil Bridge Road)	12.25
KWA	Restoring water supply pipelines at Aduppil Kettil - 12.80 lakhs Vadakara Water Supply Scheme - Repair works - 22.50 lakhs	0.353
Soil Conservation Department	Vilangad-Panyam landslide prevention project - 1000 sq. m stone embankments, 40 m side protection wall lost	0.0558452
KSEB	Loss Calculated by generation to the damages occurred at SHEP Vilangad a) Generation and Rectification loss - 2.16 Cr. b) Capital Loss - 2.466 Cr. Loss calculated by Distribution to the damages occurred at ES Parappupara - 1.2 Cr. Loss calculated by transmission wing - 0.2 Cr	6.026
Irrigation Dept	Work to prevent river erosion at Mahe river - 32 Cr. Cleaning debris from downstream of Vayad colony to Mahe river - 8 Cr.	40
PWD Electrical	Chengod Village office -- restoring the connectivity of the damaged plug points in the office cubicle - 25,000 Naripatta Village office - restoring the damaged 3 KVA Hykon make UPS - 40,000	0.0065
PWD Electronics	Villangad Village Office - 1,77,000 worth of electronic items lost Naripatta Village Office - 45,000	0.22

Joint Registrar General	Vilangad - Damage to Godown of ST Service Cooperative Society, Inventory lost and Food Processing Unit	0.25
LSG	Vanimel GP (9, 10 & 11 Wards) a) Roads - 23 no.s - 5.45 Cr. b) Water Supply Scheme - 1.02 Cr. c) Culverts and Bridges - 6.31 Cr. d)Buildings (fully damaged 2, partially damaged - 3) - 97 lakhs	14.62
	Nadapuram GP - Bridges, Roads, River Bank Protection etc.	5.82
	Naripatta GP - 30 road, 5 bridges	5.95
	Chokiyad GP - Suspension bridge and 20 roads	2
	Thuneri GP - Road	0.804
Grand total		**98.10 Cr.**

ANNEXURES



Annexures

Annexure 1: 1.14 (a)

Official Order mentioning list of District Level Nodal Officers for Coordinating Response activi-ties in Meppadi landslide

ചെയർപേഴ്സൺ, ഡി.ഡി.എം.എ & വയനാട് ജില്ലാ കളക്ടറുടെ നടപടിക്രമം

(ഹാജർ : ഡി.ആർ.മേഘശ്രീ ഐ.എ.എസ്)

വിഷയം :- ദുരന്ത നിവാരണം - ചൂരൽമല ദുരന്തം - ദുരിതാശ്വാസ പ്രവർത്തനം ഏകോപിപ്പിക്കുന്നതിന് നോഡൽ ഓഫീസർമാരെ നിയമിച്ച് ഉത്തരവാകുന്നു.

സൂചന :- സ്പെഷ്യൽ ഓഫീസറുടെ നിർദ്ദേശം.

ഉത്തരവ് നം: DCWYD/ 2864/2024-DM3 തീയതി: 01/8/2024

30/07/2024 തിയ്യതിയിൽ ചൂരൽമലയിൽ ഉണ്ടായ ഉരുൾപൊട്ടലുമായി ബന്ധപ്പെട്ട ദുരിതാശ്വാസ പ്രവർത്തനം ഏകോപിപ്പിക്കുന്നതിനായി താഴെപ്പറയുന്ന ഉദ്യോഗസ്ഥരെ നിയോഗിച്ച് ഉത്തരവാകുന്നു. ഉദ്യോഗസ്ഥർ നോഡൽ ഓഫീസറുടെ നിർദ്ദേശാനുസരണം താഴെപ്പറയുന്ന ചുമതലകൾ നിർവ്വഹിക്കേണ്ടതാണ്.

1. **രക്ഷാപ്രവർത്തനങ്ങളുടെ ഏകോപനം**

നോഡൽ ഓഫീസർ	അംഗങ്ങൾ
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	2. ശ്രീ. ബൈജു

ചുമതലകൾ :-

1. രക്ഷാപ്രവർത്തകർക്ക് ആവശ്യമായ വാഹനങ്ങൾ, ഉപകരണങ്ങൾ, ഇന്ധനം ഇവ ഉണ്ടെന്ന് ഉറപ്പുവരുത്തുക.
2. ദുരന്ത നിവാരണവും രക്ഷാപ്രവർത്തനവുമായി ബന്ധപ്പെട്ട പ്രതിദിന റിപ്പോർട്ട് DEOC യും അധികൃതർക്കും യഥാസമയം ലഭ്യമാക്കുക.

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2. **ടെക്നിക്കൽ ടീം**

നോഡൽ ഓഫീസർ	അംഗങ്ങൾ
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	7. ശ്രീ. ശബരീനാഥ്, HSC

ചുമതലകൾ

1. ദുരിതാശ്വാസ പ്രവർത്തനങ്ങൾക്ക് ആവശ്യമായ സാങ്കേതിക സാഹായം നൽകുക
2. സോഷ്യൽ മീഡിയ ടീമിനാവശ്യമായ സഹായം നൽകുക

3. ദുരിതാശ്വാസ ക്യാമ്പുകളുടെ പ്രവർത്തനം

നോഡൽ ഓഫീസർ	അംഗങ്ങൾ
ശ്രീ. ബിജു, ഡെപ്യൂട്ടി കളക്ടർ (9446522061)	ശ്രീമതി. അനുപമ ശശിധരൻ കെ.എ.എസ്

ചുമതലകൾ :-

1. ക്യാമ്പുകളുടെ അടിസ്ഥാന സൗകര്യങ്ങൾ, പ്രവർത്തനങ്ങൾ എന്നിവ ഉറപ്പുവരുത്തുക
2. അഡീഷണൽ ക്യാമ്പുകളുടെ സ്ഥലം നിശ്ചയിക്കുക.
3. ക്യാമ്പുകളിലെ ഭക്ഷണം, ശുചിത്വം, കൗൺസിലിംഗ്, സന്ദർശകർക്കുള്ള റിസപ്ഷൻ എന്നിവ ഉറപ്പുവരുത്തുക

4. പ്രത്യേക ആരോഗ്യ പ്രശ്ന ബാധിതർ, രോഗ ബാധിതർ എന്നിവരുടെ പരിചരണം

നോഡൽ ഓഫീസർ	അംഗങ്ങൾ
ഡോ. പ്രിയാ സേനൻ (9995101724)	ക്യാമ്പിന്റെ ചുമതലയുള്ള ചാർജ് ഓഫീസർ

ചുമതലകൾ :-

1. പ്രത്യേക ആരോഗ്യ പ്രശ്നമുള്ള ക്യാമ്പ് അന്തേവാസികളെ കണ്ടെത്തി അവരുടെ ആരോഗ്യ പരിരക്ഷ ഉറപ്പു വരുത്തുന്നതിനായി വിവരം ജില്ലാ മെഡിക്കൽ ഓഫീസർക്ക് കൈമാറുക
2. ക്യാമ്പിലുള്ള രോഗ ബാധിതരുടെ പരിചരണം

5. മൃതശരീരങ്ങളുടെ സൂക്ഷിപ്പും, കൈമാറ്റവും, സംസ്കരണവും

നോഡൽ ഓഫീസർ	അംഗങ്ങൾ
ശ്രീമതി ശ്രീധന്യ സുരേഷ് ഐ.എ.എസ് (9895768608)	1. ശ്രീ. അരുൺ, ഡെപ്യൂട്ടി കളക്ടർ.
	2. ശ്രീ. ബെന്നി ജോസഫ്, J.D, LSGD

ചുമതലകൾ :-

1. ദുരന്ത മേഖലയിൽ നിന്നു ലഭിക്കുന്ന മൃതശരീരങ്ങൾ യഥാവിധി പോസ്റ്റ്മോർട്ടം കേന്ദ്രങ്ങളിൽ എത്തുന്നുവെന്ന് ഉറപ്പാക്കുക.
2. പോസ്റ്റ്മോർട്ടം കഴിഞ്ഞതിന് ശേഷം മൃതദേഹങ്ങൾ അതത് സൂക്ഷിപ്പ് കേന്ദ്രങ്ങളിൽ യഥാസമയം എത്തുന്നുവെന്ന് ഉറപ്പാക്കുക.
3. മൃതദേഹങ്ങൾ തിരിച്ചറിയുന്നതിനാവശ്യമായ ക്രമീകരണങ്ങൾ ഏർപ്പെടുത്തുക.
4. മൃതദേഹങ്ങൾ ബന്ധുക്കൾക്ക് യഥാസമയം കൈമാറുക.
5. തിരിച്ചറിയാത്തതും അവകാശികൾ ഇല്ലാത്തതുമായ മൃതദേഹങ്ങൾ മറവ് ചെയ്യുന്നതിനുള്ള ക്രമീകരണങ്ങൾ SOP പ്രകാരം നടക്കുന്നുവെന്ന് ഉറപ്പാക്കുക.
6. ആവശ്യമായ സാമഗ്രികൾ, ദുരിതാശ്വാസ സാമഗ്രികളും സംഭരണവും, വിതരണവും ടീമിന്റെ ശ്രദ്ധയിൽപ്പെടുത്തി ആയവയുടെ ലഭ്യത ഉറപ്പ് വരുത്തുക.
7. ഓരോ രണ്ട് മണിക്കൂർ കൂടുമ്പോഴും ഇത് സംബന്ധിച്ച റിപ്പോർട്ടുകൾ DEOC യ്ക്കും, മറ്റ് ടീമുകൾക്കും ലഭ്യമാക്കുക.

6. കാണാതായവരുടെ വിവരശേഖരണം

നോഡൽ ഓഫീസർ	അംഗങ്ങൾ
ശ്രീ. എസ്. ഗൗതം രാജ് ഐ.എ.എസ് (8953445239)	1. ശ്രീ. നിവേദ് എസ്
	2. ശ്രീ. സിബി വർഗ്ഗീസ്

ചുമതലകൾ

1. ദുരന്തത്തിൽ കാണാതായവരുടെ എണ്ണം ശാസ്ത്രീയമായ മാർഗ്ഗങ്ങളിലൂടെ അപഗ്രഥിച്ച് നിർണ്ണയിക്കൽ

7. അതിഥി തൊഴിലാളികളുടെ പരിപാലനം

നോഡൽ ഓഫീസർ	അംഗങ്ങൾ
ശ്രീ. ജയേഷ്, ജില്ലാ ലേബർ ഓഫീസർ (9446440220)	1. 1. അസി. ലേബർ ഓഫീസർമാർ

ചുമതലകൾ

1. ദുരന്തമേഖലയിൽ പ്രവർത്തിച്ചിരുന്ന തൊഴിലാളികളുടെ വിവരങ്ങൾ ശേഖരിച്ച് DEOC യ്ക്ക് കൈമാറുക
2. ദുരന്ത ബാധിതരായ അതിഥി തൊഴിലാളികളുടെ സുരക്ഷയും ക്ഷേമവും ഉറപ്പാക്കുക.
3. അതിഥി തൊഴിലാളികളുടെ വിവരങ്ങൾ ബന്ധുക്കൾക്ക് യഥാസമയം ലഭ്യമാക്കുക.

8. I E C മാനേജ്മെന്റ്

നോഡൽ ഓഫീസർ	അംഗങ്ങൾ
ശ്രീ. സെബാസ്റ്റ്യൻ പി.ജെ iTCell Cordinator(9746239313)	1. ശ്രീ. അക്ബർ അലി

ചുമതലകൾ

1. ദുരന്തനിവാരണവുമായി ബന്ധപ്പെട്ട സന്ദേശങ്ങൾ പൊതുജനങ്ങളിലേക്ക് യഥാസമയം എത്തിക്കുക.
2. അതിഥി തൊഴിലാളികൾ, ഇതര സംസ്ഥാനങ്ങളിൽപ്പെട്ടവർ എന്നിവരെ സംബന്ധിച്ച സോഷ്യൽ മീഡിയ പോസ്റ്റുകൾ യഥാസമയം തയ്യാറാക്കി ഓരോ ടീമിനും ആവശ്യമായ വളണ്ടിയർമാരെ സംബന്ധിച്ചും ക്യാമ്പുകളിലെ മെഡിക്കൽ സൗകര്യങ്ങൾ സംബന്ധിച്ചും മറ്റ് പ്രവർത്തനങ്ങളെ സംബന്ധിച്ചുമുള്ള സോഷ്യൽ മീഡിയ സന്ദേശങ്ങൾ യഥാസമയം ജനങ്ങളിലേക്ക് എത്തിക്കുക.

9..വാളണ്ടിയർ മാനേജ്മെന്റ്

നോഡൽ ഓഫീസർ	അംഗങ്ങൾ
ശ്രീ. പി സി മജീദ് (ജോയിന്റ് പ്രോഗ്രാം കോർഡിനേറ്റർ MGNREGA(9447518639)	1.കുമാരി. അപർണ്ണ , 2.ജില്ലാ കോർഡിനേറ്റർ , NYK

ചുമതലകൾ

1. വാളണ്ടിയർമാരുടെ ടീമിനെ രൂപികരിക്കുക
2. വിവിധ നോഡൽ ഓഫീസർമാർക്ക് ആവശ്യപ്പെടുന്ന വാളണ്ടിയർമാരുടെ എണ്ണം ലഭ്യമാക്കുക ആളുകളെ നിയമിക്കൽ
3. വാളണ്ടിയർമാർക്കുള്ള ചുമതലകൾ നിശ്ചയിച്ച് നൽകുക
4. വാളണ്ടിയർമാർക്കുള്ള ഐഡന്റിന്റി കാർഡുകൾ നൽകുക

10. ഡാറ്റാ മാനേജ്മെന്റ്

നോഡൽ ഓഫീസർ	അംഗങ്ങൾ
ശ്രീ. കുമാരി അഖില സി ഉദയൻ കെ എ എസ്	1. ശ്രീ. നിവേദ് എസ് 2 .ജില്ലാ മെഡിക്കൽ ഓഫീസർ പ്രതിനിധി

ചുമതലകൾ

താഴെ ചേർക്കുന്ന വിവരങ്ങളുടെ ശേഖരണം, ക്രോഡീകരണം

1. ദുരന്തത്തിൽ മരിച്ചവരുടെ എണ്ണം
   a. പോസ്റ്റ് മോർട്ടം നടത്തിയവയുടെ എണ്ണം
   b. ബന്ധുകൾക്ക് വിട്ടു കൊടുത്തത്
   c. തിരിച്ചറിയാത്തവരുടെ എണ്ണം
3. ആശുപത്രിയിൽ ചികിൽസയിലുള്ളവരുടെ എണ്ണം
4. പ്രസ്തുത വിഷയത്തിൽ ജില്ലാ ദുരന്ത നിവാരണ അതോറിറ്റി ആവശ്യപ്പെടുന്ന വിവരങ്ങൾ

11. കോൾ സെന്റർ മാനേജ്മെന്റ്

നോഡൽ ഓഫീസർ	അംഗങ്ങൾ
ശ്രീ. ഷാജി പി മാത്യു	DEOC ടീം

ചുമതലകൾ

1. ദുരന്തവുമായി ബന്ധപ്പെട്ട് വരുന്ന ടെലഫോൾ കോളുകൾ രേഖപ്പെടുത്തി അവയ്ക്ക് മറുപടി നൽകി വിവരം രേഖപ്പെടുത്തുക

12 ദുരിതാശ്വാസ സാമഗ്രികളുടെ സംഭരണവും വിതരണവും

നോഡൽ ഓഫീസർ	അംഗങ്ങൾ
ശ്രീ. മിസാൽ സാഗർ ഭാരത് ഐ.എ.എസ്	1. ശ്രീമതി. അനിതകുമാരി, Dy.Col (LA)
	2. ശ്രീ. മനോജ് കുമാർ, സീനിയർ സൂപ്രണ്ട്
	3 ശ്രീ. ശിവദാസൻ,തഹസിൽദാർ (ആർ.ആർ അമ്പലവയൽ)

ചുമതലകൾ :-

1. ദുരിദാശ്വാസ ക്യാമ്പുകൾ, രക്ഷാപ്രവർത്തകർ, ഉദ്യോഗസ്ഥർ, ആശുപത്രികൾ, മറ്റ് സ്ഥാപനങ്ങൾ എന്നിവയ്ക്ക് ദുരന്ത നിവാരണവുമായി ബന്ധപ്പെട്ട് ആവശ്യമായ സാമഗ്രികൾ സംഭരിക്കുക.
2. ക്യാമ്പ് ചാർജ്ജ് ഓഫീസർമാരുടെയും ആരോഗ്യ വകപ്പിന്റെയും മറ്റ് ടീമുകളുടേയും ആവശ്യാനുസരണം ദുരിതാശ്വാസ സാമഗ്രികൾ യഥാസമയം വിതരണം ചെയ്യുക.
3. ഓരോ ദിവസവും അടുത്ത 3 ദിവസങ്ങളിലേക്ക് ആവശ്യമായ സാധന സാമഗ്രികൾ വിതരണം നടത്തിയെന്നും, ആയവയുടെ ലഭ്യത ഉണ്ടെന്നും ഉറപ്പ് വരുത്തുക.
4. ദുരിതാശ്വാസ പ്രവർത്തനങ്ങളിൽ ഏർപ്പെട്ടിട്ടുള്ള എല്ലാ ഉദ്യോഗസ്ഥർക്കും വോളണ്ടിയർമാർക്കും ആവശ്യമായ ഐഡന്റിറ്റി കാർഡുകൾ നൽകുക.

13. കൗൺസിലിംഗ് സേവനം

നോഡൽ ഓഫീസർ	അംഗങ്ങൾ
ശ്രീ പ്രജിത് കെ, ജില്ലാ സാമൂഹ്യ നീതി ഓഫീസർ (9744022002)	1. ജില്ലാ വനിതാ ശിശു വികസന ഓഫീസർ
	2. ശ്രീമതി പ്രിയസേനൻ, ഡെപ്യൂട്ടി ഡി.എം.ഓ
	3. ശ്രീമതി. സമീഹ, ഡി.പി.എം, NHM
	4. ശ്രീ. ബിബിൻ സി ടി, Member CWC

ചുമതലകൾ

1. ദുരന്തബാധിതർക്ക് മാനസികവും സാമൂഹികവുമായ പിന്തുണ കൗൺസിലിംഗ് വഴി ഉറപ്പുവരുത്തുക.
2. പോസ്റ്റ് ട്രോമാറ്റിക് ഡിസാസ്റ്റർ സിൻഡ്രോം ദുരന്തബാധിതരിൽ ഇല്ലെന്ന് ഉറപ്പുവരുത്തുക.

14 വെഹിക്കിൾ മാനേജ്മെന്റ്

നോഡൽ ഓഫീസർ	അംഗങ്ങൾ
ആർ.ടി.ഒ, വയനാട് (8547639012)	1. ജോ. ആർ.ടി.ഒ
	2. എം.വി.ഐ
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ചുമതലകൾ

1. റെസ്ക്യൂ പ്രവർത്തനങ്ങൾ, ദുരിതാശ്വാസ സാമഗ്രികളുടെ വിതരണം എന്നിവയ്ക്കാവശ്യമായ വാഹനങ്ങൾ ഏർപ്പാടാക്കി നൽകുക.

15. മാലിന്യ സംസ്കരണം

നോഡൽ ഓഫീസർ	അംഗങ്ങൾ
ജില്ലാ കോർഡിനേറ്റർ, ഹരിത മിഷൻ	1.തദ്ദേശ ഭരണ ജോയിന്റ് ഡയറക്ടർ പ്രതിനിധി 2. ജില്ലാ മിഷൻ കോർഡിനേറ്റർ, കുടുംബശ്രീ

ചുമതലകൾ

1. ദുരന്തബാധിത പ്രദേശത്തെയും ക്യാമ്പുകളിലെയും മാലിന്യങ്ങൾ യഥാവിധം സംസ്കരിക്കുന്നു എന്ന് ഉറപ്പു വരുത്തുക.

പൊതു നിർദ്ദേശങ്ങൾ

1. നോഡൽ ഓഫീസർമാർക്ക് ആവശ്യമായ വോളണ്ടിയർമാർ മറ്റു ഉദ്യോഗസ്ഥർമാർ എന്നിവരെ ആവശ്യാനുസരണം നിയോഗിച്ച് നൽകുന്നതാണ്.
2. നോഡൽ ഓഫീസർ പ്രസ്തുത വിഷയവുമായി ബന്ധപ്പെട്ട് ജില്ലാ ദുരന്ത നിവാരണ അതോറിറ്റി ആവശ്യപ്പെടുന്ന ചുമതലകൾക്കുടി നിർവഹിക്കേണ്ടതാണ്.

02/08/24

ചെയർപേഴ്സൺ, ഡി.ഡി.എം.എ & ജില്ലാ കളക്ടർ,
വയനാട്.

Social Sectors

Housing

Annexure 1: 2.1 Calculation of Unit/cost

Housing construction by owner	**INR/sq. m.**
Basic cost of construction	1,95,00
Water supply and sanitary installation 12.5%	2437.5
Internal electrical installation 12.5%	2437.5
Site Development 5%	975
Add 1% Labour cess	195
Add 1% quality control	195
Add 3% Contingency	585
Total unit cost of Reconstruction INR/sq. m.	**26325**

Annexure 2: 2.2 Count of number of houses with damage

Number of houses in Ward 10, 11 & 12	**No. of houses with 100% damage**	**No. of houses with 50% damage**	**No. of houses with 20% damage**	**Total**
Ward No-10	689	31		720
Ward No -11	486	18		504
Ward No-12	125	55	603	783
Total	**1300**	**104**	**603**	**2007**

Annexure 3: 2.3 Average plinth area of damaged houses

Plinth area of houses in Ward No. 10, 11 & 12	Average plinth of houses with 100% damage	Average plinth of houses with 50% damage	Average plinth of houses with 20% damage	Average plinth area
10	50.44	48.47	-	50.35
11	53.53	108.83	-	55.50
12	54.43	52.97	62.62	60.64
Total Average Plinth area	**51.98**	**61.30**	**62.62**	**55.66**

Education

Annexure 1: 4.1 Data Collection Template

വയനാട് മുണ്ടക്കൈ ദുരന്തത്തിന്റെ പശ്ചാത്തലത്തിൽ വിദ്യാർത്ഥികളുടെ വിവരശേഖരണത്തിനു വേണ്ടി പൊതുവിദ്യാഭ്യാസ വകുപ്പ് തയ്യാറാക്കിയ ഫോർമാറ്റ്

വിദ്യാലയത്തിലെ ഓരോ ക്ലാസിലെയും കുട്ടികളുടെ താൽക്കാലിക വിവരങ്ങൾ ക്ലാസ് ടീച്ചറുടെ ചുമതലയിൽ കൃത്യതയോടെയും ഉത്തരവാദിത്തത്തോടെയും ഇതോടൊപ്പമുള്ള ഫോർമാറ്റിൽ രേഖപ്പെടുത്തേണ്ടതാണ്.

സ്കൂൾ : ----------

ക്ലാസ് : ----------

ഡിവിഷൻ : ----------

ക്ലാസ്സിലെ കുട്ടികളുടെ എണ്ണം : ----------

കുട്ടിയെ കുറിച്ചുള്ള വിവരങ്ങൾ

കുട്ടിയുടെ പേര് : ---------- ആൺ / പെൺ

അച്ഛന്റെ പേര് : ----------

അമ്മയുടെ പേര് : ----------

പഞ്ചായത്ത് : ----------

വാർഡ് : ----------

SC	ST	OBC	OEC	General

(ടിക്ക് ചെയ്യുക)

ഭിന്നശേഷി : അതെ / അല്ല

കുട്ടിയെ സംബന്ധിച്ച തൽസ്ഥിതി

ഫോൺ വഴി ലഭ്യമാണ് : അതെ / അല്ല

വിളിച്ചിട്ട് കിട്ടുന്നില്ല / പ്രതികരണമില്ല: അതെ / അല്ല

കുടുംബത്തിലെ മറ്റ് അംഗങ്ങളെ ബന്ധപ്പെടാൻ പറ്റുന്നുണ്ട്: അതെ / അല്ല

കാണാതായതായി സ്ഥിരീകരിച്ച: അതെ / അല്ല

മരണമടഞ്ഞതായി സ്ഥിരീകരിച്ച: അതെ / അല്ല

കുടുംബത്തെക്കുറിച്ചുള്ള വിവരങ്ങൾ

അച്ഛൻ (മാത്രം) നഷ്ടപ്പെട്ട/ കാണാതായി: അതെ / അല്ല

അമ്മ നഷ്ടപ്പെട്ട/കാണാതായി: അതെ / അല്ല

സഹോദരങ്ങൾ നഷ്ടപ്പെട്ട/കാണാതായി: അതെ / അല്ല

അച്ഛനും അമ്മയും നഷ്ടപ്പെട്ട: അതെ / അല്ല

കുടുംബം ഒന്നടങ്കം നഷ്ടപ്പെട്ട/ കാണാതായി : അതെ / അല്ല

വീടിന്റെ അവസ്ഥ

വീട് പൂർണമായി നഷ്ടപ്പെട്ടു: അതെ / അല്ല

വീട് ഭാഗികമായി നഷ്ടപ്പെട്ടു: അതെ / അല്ല

വീട് താമസയോഗ്യമല്ലാതായി: അതെ / അല്ല

നിലവിലെ സ്ഥിതി

ദുരന്തത്തെ തുടർന്ന് ആശുപത്രിയിൽ ചികിത്സയിൽ ആണ്: അതെ / അല്ല

ദുരിതാശ്വാസ ക്യാമ്പിൽ ആണ്: അതെ / അല്ല

ബന്ധു വീട്ടിൽ ആണ്: അതെ / അല്ല

സ്വന്തം വീട്ടിൽ കഴിയുന്നു.: അതെ / അല്ല

പാഠപുസ്തകങ്ങൾ/ പഠനോപകരണങ്ങൾ

പാഠപുസ്തകങ്ങൾ നഷ്ടപ്പെട്ടു: അതെ / അല്ല

പഠനോപകരണങ്ങൾ (നോട്ട് ബുക്ക്, ബാഗ്, Uniform ഉൾപ്പെടെ) നഷ്ടപ്പെട്ടു: അതെ / അല്ല

നേരത്തെ തന്നെ ആരോഗ്യ പ്രശ്നങ്ങൾ ഉണ്ട് : ഉണ്ട് / ഇല്ല

കുട്ടിക്ക് അടിയന്തര ആവശ്യങ്ങൾ എന്തെല്ലാം:

റിപ്പോർട്ട് ചെയ്യേണ്ട മറ്റു വിവരങ്ങൾ:

ക്ലാസ് ടീച്ചറുടെ പേര് : ----------

ഫോൺ : ----------

Annexure 2: 4.2 List of articles needed for the makeshift arrangements at GHSS Meppadi for starting damaged schools

Sl. No.	Name of Item	GLPS Mundakkai	GVHSS Vellarmala	VHSS Section in GVHSS Vellarmala	Total
1	Toilets for Girls	2		8	10
2	Toilets for Boys	2		8	10
3	Toilet for Staff	1		1	2
4	Table (Small)	10	60		70
5	Chair (Small)	10	60		70
6	Table for Classroom	7		4	11
7	Chair	7	-	25	32
8	Desk	15	120	40	175
9	Bench	15	120	40	175
10	Table for Staff Room	7	17	13	37
11	Chair for Staff Room	7	17	13	37
12	Shelf for Staff	7	17		24
13	Table for Office Room	2	3	3	8
14	Chair for Office Room	2	14	-	16
15	Shelf for Office	4	10	4	18
16	Laptop with Printer for Office	1	1	1	3
17	Internet for Office	1	1	-	2
18	Photocopier	-	1	-	1

Sl. No.	Name of Item	GLPS Mundakkai	GVHSS Vellarmala	VHSS Section in GVHSS Vellarmala	Total
19	Fiel Rack	1	1	-	2
20	Fiel Pads	50	100	-	150
21	Laptop	1	1	-	2
22	Register Rack	1	1	-	2
23	CCTV	-	1	-	1
24	Shelf for Class Room	6	-	4	10
25	Laptop for Class Room	6	17	4	27
26	Projector	6	17	4	27
27	HDMI Cable 3 mtr.			4	4
28	HDMI Cable 10 mtr.	6	17	4	27
29	Face Plate	6	17	4	27
30	Mounting Kit	6	17	4	27
31	Speaker	6	17	4	27
32	White Board	6	17	4	27
33	Atlas for Geography Lab			4	4
34	Podium with Shelf	-	17	-	17
35	IT LAB	-	-	-	0
36	LAPTOPS	-	25	-	25
37	Smart Board and accessories	-	1	-	1
38	Computer Table	-	25	-	25
39	Computer Chari	-	25	-	25

Sl. No.	Name of Item	GLPS Mundakkai	GVHSS Vellarmala	VHSS Section in GVHSS Vellarmala	Total
40	UPS 5 KV	-	1	-	1
41	Printer	-	1	-	1
42	Almirah	-	4	-	4
43	WEB Cam	-	1	-	1
44	DSL Camera	-	1	-	1
45	Sound System with Mic	-	1	-	1
46	Registers	-	4	-	4
47	Wifi or Wired Net-work	-	Yes	-	-
48	Electrification	-	Yes	-	-

Annexure 3: 4.3 Lab Requirement for FTCP as per Standard list prepared by SCERT

PART A-EQUIPMENT

Sl. No.	Name	Specifications	Quantity	Approx. Rate	Amount
1	Computer (Desktop)	As per Kerala Govt specification	15 Nos	35000	525000
	i. Processor	8 the Generation core i3 or high			
	ii. Motherboard	OEM (Compactable with processor)			
	iii. Monitor	14” or high			
	iv. Hard disk	240 GB or high (ssd/ nvme) / 500 GB or High(hdd)			
	v. RAM	4GB DDR4L SDRAM or high			
	vi. Graphics Card	Intel HD graphics 520 or high (optional)			
	vii. Sound	Stereo speaker 2W minimum			
	viii. Key board	USB			
	ix. Mouse	USB optical			
2	Computer (Laptop)	As per Kerala Govt specification	15 Nos	40000	600000
	Computer (Laptop)	As per Kerala Govt specification			
	i. Processor	8 the Generation core i3 or high			
	ii. Motherboard	OEM (Compactable with processor)			
	iii. Monitor	14” or high			
	iv. Hard disk	240 GB or high (ssd/ nvme) / 500 GB or High(hdd)			
	v. RAM	4GB DDR4L SDRAM or high			
	vi. Graphics Card	Intel HD graphics 520 or high (optional)			
	vii. Sound	Stereo speaker 2W minimum			
	viii. Key board	USB			
	ix. Mouse	USB optical			
3	LaserJet printer with networking features	Printer resolution – 600 DPI or high Print speed – 23 pages or high Internal memory – 64 Mb or high With networking features	1	15000	15000

SL No	Name	Specifications	Quantity	Approx. Rate	Amount
4	Ink jet printer	Printer resolution – 600 DPI or high Print speed – 20 pages or high Internal memory – 128 Mb or high	1	15000	15000
5	Web camera	640 x 480 sensor resolution	1	2500	2500
6	Projector	DLP, MAX Resolution 1920X1200, HDMI support, computer compatibility, NTSC, PAL, SECAM, HDTV, EDTV, SDTV video compatibility, lamp type UHP 210 W, Std mode brightness 4000 lm,	1	40000	40000
7	Network switches	4 ports ,8 port and 24 port, 10/100/1000 Mbps	1 each	20000	20000
8	Wi-Fi router	100 Mbps speed or High Frequency: 2.4 Ghz or 5 Ghz External Antenna	1	4000	4000
9	1KVAUPS with external battery	1000VA/600W min, Battery voltage -12 V/100Ah min,	1	30000	30000
10	External Hard disk (SSD)	1 TB or Higher	1	12000	12000

SL No	Name	Specifications	Quantity	Approx. Rate	Amount
11	Pen drive	Usb 3.1 or Higher ,32 GB or Higher	6	600	3600
12	Variable DC power supply	0-30V 0-2A Variable Power Supply Linear with Coarse and Fine Controls and Output On/Off Switch with voltage live control, LED Display, with Overload Protection & Short Circuit Protection.	2	6000	1200
13	SMPS Tester	20/24 Pin with various port	3	1500	4500
14	Multi meter (Digital)	DC voltage 0.1 mv - 1000v AC Voltage 0.1 mv - 750 v AC &DC Current range 15 A, LCD display, equipped with comfortable protective cover, Test probe holder, 3.5 digit, Safety class I CAT II 600V	5	1500	7500
15	Vacuum cleaner	350 W for desktop CPU cleaning	1	4000	4000
16	Network Cable tester	RJ 45 Connectivity	4	1000	4000
17	Air Blower	550 w /14000 rpm or High	1	1600	1600

SL No	Name	Specifications	Quantity	Approx. Rate	Amount
11	Pen drive	Usb 3.1 or Higher ,32 GB or Higher	6	600	3600
12	Variable DC power supply	0-30V 0-2A Variable Power Supply Linear with Coarse and Fine Controls and Output On/Off Switch with voltage live control, LED Display, with Overload Protection & Short Circuit Protection.	2	6000	1200
18	SMD Rework Station	Hot Air Gun Soldering Station 850 watt. SMD Rework Station for All Types of Circuits/PCB or Motherboard for Removing components/ IC/Port/Jack Etc	1	4000	4000
19	UPS	Compact Design Line Interactive UPS with Load Capacity of 360Watts / 600VA with built in battery	2	2500	5000
	Total				**1309700**

PART B – CONSUMABLES

SL No	Name	Specifications	Quantity	Approx Rate	Amount
1	Electrolytic capacitor	1uf ,10 Uf	15 each	1	15
2	Transformer	12-0-12 – 500ma,9-0-9 – 500ma	5 each	300	1500
3	Diode	1N4007	25 nos.	1	25
4	Transistor	BC547	25 nos.	10	250
5	Resistors (1/4 W)	Carbon composition resistor-10 different values	25 each	1	25
6	UTP Cat 6 cables	4 pair unshielded cable for LAN	90 mtr.	40	3600
7	RJ 45 Modular jack	For LAN	10 nos.	100	1000
8	RJ 45 Connector	For LAN	100 nos.	4	400
9	Heat Sink compound	100 gms	1	300	300
10	Soldering flux	100 gms	6 nos.	200	1200
11	Solder	100 gms ,60/40	6 nos.	500	3000
12	Logic gate IC	7400,7402,7404,7408,7432	10 each	50	500
13	LED	2v/.5A	25 nos.	2	50
14	Single strand Wire	For Bread board	90 mtr.	250	22500
15	Gloves	Rubber	10 pair	100	1000
16	White Board marker	Blue, Black	10 each	250	2500
17	First Aid kit	With latest emergency medicine	1	500	500
18	HDMI cable	15 mtrs.	1	1500	1500

SL No	Name	Specifications	Quantity	Approx Rate	Amount
19	Cleaning kit for laptop	Cleaning kit for monitor, laptop screen Professional quality prevent static electricity,100 ml solution with microfiber cloth and soft brush	3 nos.	1000	3000
20	White board eraser	plastic	2 nos.	300	600
	Total				**43465**

PART C – FURNITURE

SL No	Name	Specifications	Quantity	Approx Rate	Amount
1	White board	White board with aluminium frame 180 x 120 cm	2 nos.	2000	4000
2	Almirah	Steel cabinet with 4 shelves 198x 90 x48 cm ,20 Gauge	3 nos.	18500	55500
2	Shelf	Steel slotted angle iron rack (6 panel) 180 x 90 x 38 cm	3 nos.	4000	12000
3	Computer table	Computer table with key-board 90 x 45 x 75 cm	20 nos.	3750	75000
4	Computer Chair	Metal, Adjustable Height, Ergonomic, Arm Rest.	20 nos.	3500	70000
	Total				**216500**

Annexure 4: 4.4 Grand Total for IT Facilities

Part A-equipment	1309700.00
Part B - tools and accessories	234050.00
Part C– consumables	43465.00
Part D – furniture	216500 .00
Grand Total for FTCP	1803715.00

Annexure 5: 4.5 Academic recovery program

Week Academic Recovery Programme for Primary students MATHS, EVS, Malayalam, English (4 subjects) total 20 persons	No of days/ PAGE	Amount	Persons/Copies	
Travelling allowance for the resource persons as per KSR for 20	1	1500	20	30000
Remuneration @ 1000	5	1200	20	120000
Contingency@60 participants	5	60	20	6000
Food and accomodation@800/participants	5	800	20	80000
Printing/Actual for 160-page workbook(160x3x350)	160	3	350	168000
Venue arrangements/Actual	5		5	25000
Teacher training familiarization 11 schools once teacher each subject	1	600	50	30000
Workshop for 20 days for students	20	100	350	700000
Total				**1159000**

Week Academic Recovery Programme for Upper Primary students Maths, Science Social Science, Malayalam, English and Hindi (6 subjects) total 30 persons	**No of days/ PAGE**	**Amount**	**Persons/Copies**	
Travelling allowance for the resource persons as per KSR for 30	1	1500	30	45000
Remuneration @ 1000	5	1200	30	180000
Contingency@60 participants	5	60	30	9000
Food and accomodation@800/participants	5	800	30	120000
Printing/Actual for 240-page workbook(240x3x350)	240	3	350	252000
Venue arrangements/Actual	5	5000		25000
Teacher training familiarisation 11 schools once teacher each subject	1	600	70	42000
Workshop for 20 days for students	20	100	350	700000
Total				**1373000**

Week Academic Recovery Programme for High school students Maths, Science Social Science, Malayalam, English and Hindi (8 subjects) total 40 persons	**No of days/ PAGE**	**Amount**	**Persons/Copies**	
	5	1200	40	240000
Travelling allowance for the resource persons as per KSR for 40	5	60	40	12000
Remuneration @ 1000	5	800	40	160000
Contingency@60 participants	5	60	40	12000
Food and accomodation@800/participants	5	800	40	160000

Printing/Actual for 320-page workbook(320x3x250)	320	3	250	240000
Venue arrangements/Actual	5	5000	1	25000
Teacher training familiarisation 3 schools once teacher each subject	1	600	70	42000
Workshop for 20 days for students	20	100	250	500000
Total				**1391000**

Week Academic Recovery Programme for Higher secondary school students 8 Combinations (8 subjects) total 40 persons	**No of days/ PAGE**	**Amount**	**Persons/Copies**	
	5	1200	40	240000
Travelling allowance for the resource persons as per KSR for 40	5	60	40	12000
Remuneration @ 1000	5	800	40	160000
Contingency@60 participants			40	336000
Food and accomodation@800/participants	5		5	25000
Printing/Actual for 320-page workbook(320x3x150)	320	3	150	144000
Venue arrangements/Actual	5	5000	1	25000
Teacher training familiarisation 3 schools once teacher each subject	1	600	30	18000
Workshop for 20 days for students	20	100	150	15000
Total				**975000**
Grand Total for the 8-week academic programme				**4898000**

Annexure 6: 4.6 Baseline information of educational facilities in Wayanad District

Educational Facilities	Govt	Govt. Aided Education Facilities	Total	Number Of Students			Number of Teachers	
				Male	Female	Total	Male	Female
Pre-Primary School (+3+4)	129	72	201	4871	4787	9658	26	175
Primary School Independent 1- 4	87	41	128	7829	7384	15213	197	581
Primary School Independent 1- 5 only	3	5	8	647	634	1281	17	42
Primary School Independent 1- 7 only	21	37	58	16097	15895	31992	290	899
Primary School Independent 5- 7 only	0	5	5	915	846	1761	18	55
Secondary School 1 to 12	23	5	28	18326	17048	35374	360	844
Secondary School 1to 10	19	1	20	10800	10648	21448	124	370
Secondary School 5 to 10	1	0	1	544	504	1048	4	9
Secondary School 6 to 10	1	0	1	149	151	300	5	10
Secondary School 8 to 10	1	3	4	1174	1228	2402	35	57
Secondary School 8 to12	8	11	19	9188	9910	19098	259	477
Secondary School 5 to12	9	5	14	9213	8663	17876	248	479
Secondary School 6 to 12	1	0	1	973	1047	2020	30	49
1 to 10 WITH VHSE	0	0	0			0		
1 to 12 WITH VHSE	3	1	4			0		
6 to 10 WITH VHSE	0	0	0			0		
5 to 10 WITH VHSE	0	0	0			0		
5 to 12 WITH VHSE AND HSS	3	0	3			0		
6 to 12 WITH VHSE AND HSS	1	0	1			0		
8 to 12 WITH VHSE AND HSS	0	1	1			0		
VHSS ONLY (THS VHS Bathery)	1	0	1	211	20	231		
Others			0					
TOTAL schools in the District	**311**	**187**	**498**	**80937**	**78765**	**159702**	**1613**	**4047**

Health and Nutrition

Annexure 1: 5.1 Unit Cost of Building and Equipping a HWC (IPHS Standards 2022)

Name of Equipment		Unit cost
Weighing Machine Digital	2	1200
Height Measuring Scale	1	900
Finger Tip Pulse Oximeter	2	3000+
Finger Tip Pulse Oximeter	2	1300
BP Apparatus -Digital	3	2500
Stethoscope	2	1000
Autoclave small	1	8000
Baby Weighing Machine Digital	1	6500
Infantometer	1	3000
Examination Table	1	8000
Foot Step	1	3500
Nebulizer	1	2600
Glucometer with strip 50 strip)	2	800+ 1500
Spot light	2	17437(KMSCL RC)
IUD cot	1	20000
Table with drawer	5	6500
Chair –Push Back	5	3500
Chair at waiting area (Plastic)	10	450
Cupboard with lock (Almirah)	2	6000
Fetal Doppler	2	3848.32(KMSCL RC)
Torch rechargeable	2	600
Bed sheet	6	250
IUD instruments	1 set	4000
Instruments for Emergency management	2 set	5000
Oxygen concentrator	1	45000
Emergency Lamp	1	1500
Inverter 2 KVA with battery	1	50000
Total		**181300**

Annexure 2: 5.2 List of Equipment for Clinic

Name of Equipment	Quantity	Unit Cost	Amount
Basin 825ml	1	INR695	INR695
2 Basin Deep - 6 Ltr.	1	INR 2,100	INR 2,100
3 Instrument Tray with Lid	2	INR 1,470	INR 2,940
Flash Light	1	INR 1,950	INR 1,950
Torch	1	INR 675	INR 675
Dressing Drum SS	2	INR 1,470	INR 2,940
Surgical Scissor Straight	1	INR 435	INR 435
Cusco Speculam Small	1	INR 630	INR 630
Cusco Speculam Medium	2	INR 630	INR 1,260
Cusco Speculam Large	1	INR 630	INR 630
Cheatle Forceps 10"	1	INR 1,020	INR 1,020
Cheatle Forceps Holder SS	1	INR 560	INR 560
Sponge Holding Forceps 10	2	INR 980	INR 1,960
Dressing Forceps Plain	2	INR 275	INR 550
Dressing Forceps Toothed	2	INR 275	INR 550
Needle Holder 6*	2	INR 685	INR 1,370
Kidney Tray SS	2	INR 253	INR 506
Artery Forceps 6* Straight	4	INR 485	INR 1,940
Hub Cutter	1	INR 600	INR 600
Dressing Forceps Spring Type	4	INR 275	INR 1,100
Ambu Bag Paediatric - KMSCL	1	INR 870	INR 870
BP Handle SS	2	INR 98	INR 196
Nasal Prongs	2	INR 29	INR 58
Oxygen Mask Adult	2	INR 29	INR 58

Name of Equipment	Quantity	Unit Cost	Amount
Oxygen Mask Paediatric	2	INR 29	INR 58
Measuring Tape	1	INR 17	INR 17
Artery Forceps Curved	4	INR 485	INR 1,940
Digital BP Apparatus	1	INR 1,700	INR 1,700
Digital Thermometer	1	INR 94	INR 94
Tounge Dipressor SS	1	INR 39	INR 39
Mouth Gag	1	INR 1,950	INR 1,950
Mouth Mirror	1	INR 45	INR 45
Snellans Chart	1	INR 40	INR 40
Near Vision Chart	1	INR 20	INR 20
Stediometer	1	INR 220	INR 220
Gauze Cutting Scissor	1	INR 535	INR 535
Kits for Testing Residual Chlorine	1	INR 450	INR 450
Hemoglobin meter acuteck	1	INR 2,232	INR 2,232
Digital weighing machine wb101	1	INR 1,229	INR 1,229
Digital baby weighing machine samso flex-20	1	INR 2,712	INR 2,712
Weighing machine baby hanging type	1	INR 1,186	INR 1,186
Autoclave vertical small /	1	INR 10,593	INR 10,593
6 stethoscope st-150 microtone	1	INR 268	INR 268
Fetal doppler ad51b dr.odin	1	INR 2,232	INR 2,232
Iv stand full ss	1	INR 1,695	INR 1,695

Name of Equipment	Quantity	Unit Cost	Amount
Examination light	1	INR 3,125	INR 3,125
Infantometer krups	1	INR1,186	INR1,186
Nebulizer alpha lifeline	1	INR 1,071	INR 1,071
Glucometer with strips and lancet	1	INR 750	INR 750
Fiber chair armless	20	INR 600	INR 12,000
Semifowler cot (2 section):	2	INR 15,757	INR 31,514
Foot step double	1	INR 1,500	INR 1,500
Revolving stool full ss tubular tripod base with ss	2	INR 5,570	INR 11,140
Dispensing table with bottom shelf	1	INR 7,600	INR 7,600
Pharmacy chair	1	INR 4,300	INR 4,300
Steel slotted angle rack 72"*36"15" 6 pannel (20g) cr sheet	1	INR 4,353	INR 4,353
Steel cabinet with 4 fixed shelves	1	INR 8,678	INR 8,678
Table	4	INR 20,000	INR 80,000
Revolving Chair	4	INR 6,000	INR 24,000
Examination table	2	INR 7,400	INR 14,800
Medicine			INR 1,000,000
Total			**INR 1,260,866**

Annexure 3: 5.3 HR In Clinic with Evening OPD

Category Of Staff	Number	Per Month expense
Doctor (MBBS)	1	INR 55,000
Staff Nurse	2	INR 20,500X 2
Pharmacist	1	INR 17,000
DEO	1	INR 16,250
Lab tech	1	INR 17,000
Cleaning Staff	1	INR 12,600
Total		**INR 158,850**

Public, Community and Commercial Infrastructure

Annexure 1: 3.1 Details of religious: Pre-disaster information

Religious Buildings (LSG DM Plan 2020)					
Sl. No.	**Building type**	**Name**	**Ward No.**	**Ward Name**	**Area**
1	Church	Choorlamala St. Sebastian Church	12	Choorlamala	160
2	Temple	Devi Temple	10	Attamala	
3	Temple	Shiva Temple	12	Choorlamala	25
4	Mosque	Attamala Masjid	10	Attamala	89
5	Mosque	Mundakkai Masjid	11	Mundakkai	98
6	Mosque	Choorlamala Juma Masjid	12	Choorlamala	100

Annexure 2: 3.2 Details of commercial and public building

Commercial and public buildings			
Sl. No.	**Category**	**Type**	**Number**
1	Commercial	Tailoring Shops	3
2	Commercial	Bakery	6
3	Commercial	Hotel	3
4	Commercial	Beauty Parlour / Barber Shops	4
5	Commercial	Supermarkets	4
6	Commercial	Medical shops and labs	2
7	Commercial	Fish and Meat stalls	5
8	Commercial	Hardware and Furniture	13
9	Commercial	Other Shops	66
10	Community	Halls	1
11	Community	Religious Buildings	6
12	Community	Playground	2
13	Public	Public Offices	3
14	Public	Post Office	2

Annexure 3: 3.3 Details of Loss data (*See Page 565-575*)

Category	Shop Owner	Shop Type	Approx. Loss*	Loan	Inventory Loss	Income Loss	Amount Loan	Total Loss	Bank
Commercial Units	Moldeen kutty, Paramban House, Churalmala. Ph: 9387217426	Fish Market	4 lakhs	4 Lakhs Kerala Bank, KGB	4	12.6	4	20.6	Kerala Bank, KGB
Commercial Units	Anshad, Mampattaparambil, Churalmala. Ph: 7034892889	Gents Beauty Parlour	2 lakhs	1.5 lakhs KGB chooralmala	2	12.6	1.5	16.1	KGB
Commercial Units	Bhasheer T., Padijarayil House Churalmala	Bismi Hotel	15 lakhs		15	12.6		27.6	
Commercial Units	Abdul Azez, Pookattil House, Vellarimala. Ph:9605848205	Pookattil Store, Grosery and Stationery	10 lkahs	2.85 lakhs KGB Chooralmala	10	12.6	2.85	25.45	KGB
Commercial Units	Haneefa V.K., Velliyankallan House, Elavayal	V. K. Traders Spices Wholesale & Retail	19 lakhs	KGB-5 lakhs Kerala Bank-5 lakhs, Kerala Bank-10lakhs	19	12.6	10	41.6	Kerel Bank, KGGB
Commercial Units	Ph:9539396789 Maimoona.K., Kulakadan House Churalmala Ph:9961290579	Kulakadan Store Grocesery Shope	3 lakhs	1.75 GL KGB	3	12.6	1.75	17.35	KGB
Commercial Units	Reji P.T., Palipurakal House Vellarmala Ph:9656320058	St. Thomas Flour Mill	40 lakhs	5 lakhs Kerala Bank, 1.2 lakhs KGB, 4 lakhs KGB, 30,000 GL KGB	40	12.6	10.5	63.1	Kerela Bank, KGB

Category	Shop Owner	Shop Type	Approx. Loss*	Loan	Inventory Loss	Income Loss	Amount Loan	Total Loss	Bank
Commercial Units	Reji P.T., Palipurakal House Vellarmala Ph:9656320058	St. Thomas Store Masala Powder Sale	20 Lakhs		20	12.6	0	32.6	
Commercial Units	Roy.P.D Padipurakkal Chooral mala 8075172783	Nakshathra Stationery Photostat	30 Lakhs	15 lakhs KGB	30	12.6	15	57.6	KGB
Commercial Units	N.K.Sukumaran, Sukasri (H), Chooral mala, Ph:9947456459	Sukasri Traders, Hill Produce Dealer	70 lakhs	3 Lakhs, 12 lakhs-Bob, 3 lakhs G.L., 2 Lakhs-KGB, 85000 -G.L-KGB	70	12.6	20.85	103.45	BOB, KGB
Commercial Units	Souphiya Thazhathekulathil, Chooral mala, 9544962275	T.K Handcrafts & Stationery	5.25 Lakhs	2 Lakhs Kerala Bank Chooralmala	5.25	12.6	2	19.85	Kerela Bank
Commercial Units	Najmudheen, Thazhathekalathil, Chooralmala, 8086942257	T.K.Traders, Hill Produce Dealer	4.30 Lakhs	1.50 Lakhs KGB	4.3	12.6	1.5	18.4	KGB
Commercial Units	Yoonas.P.V, Puthiyaveettil, Mundakkai, 9526083452	Safa Supermarket	70 Laks	17 Lakhs Kerala Bank	70	12.6	17	99.6	Kerel Bank
Commercial Units	Muhammadali.M, Malliyil (H), Chooralmala, 9744231236	Minnus Supermarket	30 Lakhs	5 lakhs Kerala Bank, 1 lakh KGB	30	12.6	6	48.6	Kerela Bank, KGB

Category	Shop Owner	Shop Type	Approx. Loss*	Loan	Inventory Loss	Income Loss	Amount Loan	Total Loss	Bank
Commercial Units	Breznu Kumar, Mahesh Nivas, Chooralmala, 9645341347	Hotel Family	5 Lakhs	22 Lakh KGB	5	12.6	22	39.6	KGB
Commercial Units	Sharafudheen.P, Paramban (H), Chooralmala, 9847994361	Nichoos Fancy, Stationery	7.5 Lakhs	2 Lakhs Kerala Bank, 1 Lakh-KGB	7.5	12.6	3	23.1	Kerela Bank, KGB
Commercial Units	Shahina.P, Paramban (H), Chooralmala, 9847994361	Nichoos Hardware	6.5 Lakhs		6.5	12.6	0	19.1	
Commercial Units	Yunaf.P, Pulickal, Chooralmala, 9961284885	Fida Vadakastore, Concrete Machine Cutting Machines, Equipments	15 lakhs	KGB-50,000, Kalpetta Urban Bank-1 Lakh	15	12.6	1.5	29.1	
Commercial Units	Shihabudheen.K.H. Kammandra(H), Chooralmala, 9745444625	Smart Aluminium	2.5 Lakhs	Kerala bank, 2 Lakh	2.5	12.6	2	17.1	
Commercial Units	Manikandan, palayil, Chooralmala, 9539725624	Arju Medicals	9 Lakhs	KGB-1 Lakh, Kerala Bank-5 Lakhs	9	12.6	6	27.6	
Commercial Units	Sanju. K Kaattiparambil(H) Chooralmala, 9847997439	Athalin Medical Laboratory	11 Lakhs	Kerala bank, SLakhS, KGB-3.5 Lakhs	11	12.6	8.5	32.1	

Category	Shop Owner	Shop Type	Approx. Loss*	Loan	Inventory Loss	Income Loss	Amount Loan	Total Loss	Bank
Commercial Units	Salim K, Kallumbil(H), Mukkil Peedika, Mepapdi,	A.One Furniture Manufacturing Unit	8 Lakhs	KGB-1 Lakh	8	12.6	1	21.6	
Commercial Units	Sanju K J Kaaattiparamnik (h)	Modern Furniture	8.5 Lakhs	9 Lakhs KGB	8.5	12.6	9	30.1	
Commercial Units	Sunil, Sunil Nivas, ; Chooralmala, 3747038468	MGR Store	10.5 Lakhs	Kerala Bank-1.5 Lakhs, KGB-1 Lakh	10.5	12.6	2.5	25.6	
Commercial Units	Shebeeb.K.C, Kvungal (H), Vellarmala(P), 8921834280	Track Aluminium Fabrication Furniture	7 Lakhs		7	12.6	0	19.6	
Commercial Units	Ravi.K.G, Kelloth (H), Chooralmala, 3349440382	Shrilaan Furniture	8.5 Lakhs		8.5	12.6	0	21.1	
Commercial Units	Basheer, K.M. Koorinmanil, Chooralmala, 9447779344	Gift Palace, Sports, Footware, Fancy, Gift Item	2.8 Lakhs	KGB-3 Lakhs, PNB- 1 Lakh	2.8	12.6	4	19.4	
Commercial Units	Abdul Manaf, Andhottil (H), Chooralmala, 9847283591	A.M Industrial	4.5 Lakhs	KSBCDC-4 Lakhs	4.5	12.6	4	21.1	

Category	Shop Owner	Shop Type	Approx. Loss*	Loan	Inventory Loss	Income Loss	Amount Loan	Total Loss	Bank
Commercial Units	Nishad.K Kuniyil(H), Chooralmala, 9544127782	Ayath Chicken Stall	11 Lakhs	KSBCBC-2 Lakhs	11	12.6	2	25.6	
Commercial Units	Muhammadali, Varambadan (H), Chooralmala, 7025751 205	Grocery, Vegetables, Tea, Bakery	22 Lakh	KGB-2.5 Lakhs, KGb Gold Loan-8 Lakhs, KGB-5.5 Lakhs	22	12.6	16	50.6	
Commercial Units	Muhammadali, Munnilthodi (H), Mundakkal, 8547822321	Vadaka Store	12 Lakhs	KGB-5 Lakhs	12	12.6	5	29.6	
Commercial Units	Anas P, Pandarakkal, G.H.S.S Road, Chooralmala, 8589900082	Ayisha Fancy, Sports,	5 Lakhs	Gift	5	12.6		17.6	
Commercial Units	Rasheed.M, Melekkatt, Vellarimala, 9605122174	Friends Hotel & Bakery Coolbar	16 Lakhs	KGB-1 Lakh, Kerala Bank-2 Lakhs	16	12.6	3	31.6	
Commercial Units	Noushad Bhava, Vallyathodiyil, Puthumala, 9605536144	Sayin Gents Beauty Parlour	9 Lakhs	3.5 Central Bank, 1 Lakh KGB	9	12.6	4.5	26.1	
Commercial Units	Muhammadali.P. Pandarakkal, Chooralmala, 8589900082	Royal Curtains	4 lakhs	3.5 Central Bank, 1 Lakh KGB	9	12.6	4.5	26.1	

Category	Shop Owner	Shop Type	Approx. Loss*	Loan	Inventory Loss	Income Loss	Amount Loan	Total Loss	Bank
Commercial Units	yoosaf.P, Padikkaparambil, Mundakkai, 9526438193	Najaran Store, Grocery, Bakery, Coolbar	20 Lakhs		4	12.6		16.6	
Commercial Units	T.A.Ali, Tharu Peedikayil, Chooralmala, 9744562960	Al Ameen Chicken Stall	11 Lakhs		20	12.6		32.6	
Commercial Units	Ashraf.O.D, Onathookkil (H). Meppadi,	Akshaya Center	20 Lakhs	Kerala Bank-1 Lakh, Meppadi Urba Bank-1 Lakh	11	12.6	2	25.6	
Commercial Units	Ahammed Kutty, Parathodika, Chooralmala, 8943553033	Grocery	3 lakhs	Kerala Bank-5 Lakhs	20	12.6	5	37.6	
Commercial Units	Nishadali, Kodakakd Känniyil (H). Chooralmala, 9744125563	Lyma Bakery & Borma	62 Lakhs		3	12.6		15.6	
Commercial Units	Subair Kunnummal, Chooralmala, 9605290691	Kunnummal Metals & Hardware	12 Lakhs	Kerala Bank-3 Lakhs, Central Bank 5 Lakhs	62	12.6	8	82.6	
Commercial Units	Hamsa.C.M, Chelassery, Chooralmala, 9961128967	Shalimar Textiles & Footwear	66 Lakhs		12	12.6	0	24.6	

Category	Shop Owner	Shop Type	Approx. Loss*	Loan	Invento-ry Loss	Income Loss	Amount Loan	Total Loss	Bank
Commercial Units	Nishadali, Kodakkad-kanniyll, Chooralmala, 9744125563	KKN Product Bakery Unit	40 Lakhs	PNB-5 Lakhs, KB= 5 Lakhs	66	12.6	10	88.6	
Commercial Units	Nishadali, Kodakkad-kanniyll, Chooralmala, 9744125563	KKN Product Bakery Unit	40 Lakhs		40	12.6	0	52.6	
Commercial Units	Muhammed Niyas V K, Veliyankalan, Chooral-mala, 9745408049	Thaslin Textiles & Footwear	26.5 Lakhs	KB-5 Lakhs, KGB-1 Lakhs, Urban-1 Lakh, Hedj-2 Lakhs 9 Lakhs	26.5	12.6	18	57.1	
Commercial Units	Abdul Jaleel, Alakkal (H), Mundakkal	Alakkal Store	35 Lakhs	KGB-10 Lakhs	35	12.6	10	57.6	
Commercial Units	Sajuriyas, Kollonnum-mal (H), Chooralmala, 8086569597	Madra Fresh Mart Super-market	19 lakhs	Samithi 4.5 Lakhs	19	12.6	4.5	36.1	
Commercial Units	Muhamemd Bha-va, Chooralmala, Kudukkiyil Palliyalil, 9961272994	Bakery Al Ameen Sta-tionery.	2.7 Lakhs	KGB-1 Lakh, Gold Loan-1.7 Lakhs	2.7	12.6	2.7	18	
Commercial Units	Shameerath.M, Kaip-pulli (H), Chooralmala, 9562629449	M.S Mubarak, School Stationery, Tailoring, Readymades	7.6 Lakhs		7.6	12.6	0	20.2	

Category	Shop Owner	Shop Type	Approx. Loss*	Loan	Invento-ry Loss	Income Loss	Amount Loan	Total Loss	Bank
Commercial Units	Absul Asees, Madra (H),9497533069	Madra Stores, Grocery, Bakery	23 Lakhs	KGB-3 Lakhs, SIB-1 Lakh, 4 Lakhs	23	12.6	8	43.6	
Commercial Units	Shameer.S, Cherat-til (H), Chooralmala, 9847493023	City Choice Mobile & Gift Toys	18 Lakhs	KB-15 Lakhs, KGB-1 Lakh	18	12.6	16	46.6	
Commercial Units	Balakrishnan, Enara(H), Chooralmala, 9744125689	Balakrishna Store, Gro-cery	11 Lakhs		11	12.6	0	23.6	
Commercial Units	Hunais, Chirakkal (H), Chooralmala, 9645610690	Family Hard-ware	35 Lakhs		35	12.6	0	47.6	
Commercial Units	subair, Panakkadan, Chooralmala	Sahal Tex-tiles	18 Lakhs		18	12.6	0	30.6	
Commercial Units	Abdurahiman, Subair, Valiyaparambil	Hotel sagar	8.5 Lakhs	V.B.C.B-6 Lakhs, Bajaj-3.5 Lakhs	8.5	12.6	9.5	30.6	
Commercial Units	Sidique.P. Pari-yankadan, Chooralma-la, 9744466234	Najimas Light & Sounds	48 Lakhs	KGB-1 Lakh, KB 2 Lakhs	48	12.6	3	63.6	
Commercial Units	Marz Group, Attamala, 9744231236	Glass Bridge Shop, Cool-bar Handi-craft	8 Lakhs		8	12.6	0	20.6	

Category	Shop Owner	Shop Type	Approx. Loss*	Loan	Inventory Loss	Income Loss	Amount Loan	Total Loss	Bank
Commercial Units	Marz Group, Attamala, 9744231236	Glass Bridge Shop, Coolbar Handicraft	8 Lakhs		8	12.6	0	20.6	
Commercial Units	Abubaker V.K, Vazhayaggal, Chooralmala, 9562234383	VK Store, Grocery, Bakery, Stationery	9 Lakhs	Gold Loan-3 Lakhs	9	12.6	3	24.6	
Commercial Units	Ashique, Kazhumgumkattil (H), Chooralmala, 9539842309	Harsha Light & Sounds	48 Lakhs	1 B-16 Lakhs, KGB- 1.5 Lakhs, G.L-	48	12.6	17.5	78.1	
Commercial Units	Muhammedali,K, 59 Kavedan (H), Mepapdi (p). 7025017986	Friends Chicken Stall	2.5 Lakhs	BOB-10 Lakhs	2.5	12.6	10	25.1	
Commercial Units	Muhammedali K Kavedan (H), Mepapdi (p), 7025017986	Malabar Meet & Freezer Items	1.5 Lakhs	808-10 Lakhs	1.5	12.6	10	24.1	
Commercial Units	Nameer melekkad, Chooralmala, 7034773229	MK Store Grocery	1 Laks	Kudumbashree-1 Lakh, Hyper Kodukkan-5000	1	12.6	1.05	14.65	
Commercial Units	Vasu, Parambilthazhath, Chooralmala, 7902325896	Scrap-Old materials	5 Lakhs		5	12.6	0	17.6	

Category	Shop Owner	Shop Type	Approx. Loss*	Loan	Inventory Loss	Income Loss	Amount Loan	Total Loss	Bank
Commercial Units	Lenin, Vazhekkattil, Chooralmala, 9645681758 Satahar(Late),	Good wood, Furniture	6 Lakhs	KGB-250000	6	12.6	2.5	21.1	
Commercial Units	Satahar (late); Chooramala	Tailoring Shop, Readymades	7 Lakhs		7	12.6	0	19.6	
Commercial Units	Mambaraparambil (H), Puthumala, 7034892889	Bad Boy Beauty Parlour	16.56 Lakhs	KGB-1.5 Lakhs	16.56	12.6	1.5	30.66	
Commercial Units	Chand Muhammed (Late) Kammandara (H), Chooralmala, 9961568639	Kammandara Communication, Tea, Coolbar, Bakery, Stationery	20 Laktis	Urban Bank-1 Lakh	20	12.6	1	33.6	
Commercial Units	Ashraf.P. Panjill (H), Chooralmala, 9947770544	Famous Store Stationery, Bakery, Grocery, Home appliances	51 Lakhs	KB-25 Lakhs, KGB-8,60,000, Karshika Vikasana Bank	51	12.6	33.6	97.2	
Commercial Units	Alavi, Pookuzhil (H), Mundakkal	Pookuyil Beef Stall	4 lakhs		4	12.6	0	16.6	

Approx. Loss*	Shop Type	Shop Owner	Category	Loan	Inventory Loss	Income Loss	Amount Loan	Total Loss	Bank
18 Lakhs	Stationery	Shamsudheen, Padikkaparambil, Mundakkai	Commercial Units		18	12.6	0	30.6	
7 Lakhs	National Service, Spare Parts & Tyre Works	Aboobacker, Kudukkil, Palliyalil,	Commercial Units		7	12.6	0	19.6	
5 lakhs	Barbarshop	Nizar, Chooralmala 9605562458	Commercial Units		5	12.6	0	17.6	
4 lakhs	Tailor Shop	Nazer Chooralmala 7012696887	Commercial Units		4	12.6	0	16.6	
4.5	Tailor	Ponnayan	Commercial Units		4.5	12.6	0	17.1	
13 lakhs	Studio	Aneesh Chooralmala 9605401772	Commercial Units		13	12.6	0	25.6	
4 lakhs	Tea Stall	Jafar Chooralmala 9846412097	Commercial Units		4	12.6	0	16.6	

Roads and Bridges

Annexure 1: 9.1 Damage of Bituminous Road

Name of road	Overall Length of road in m (Bituminous + CC)	Total Damage		
		100 to 70%		
		Length in km	Cost /Km	Total cost
Chooralmala to mundaki	2.500	1.00	15877840.00	15877840.00
Puchirimattom to Bridge	0.960	0.96	15364542.00	14749960.32
Puchirimattom to housing area	0.140	0.14	15364542.00	2151035.88
Puchirimattom to forest area	0.790	0.79	15364542.00	12137988.18
LP school to Padi area	0.308	0.31	15364542.00	4732278.94
Road near tea factory	1.150	1.00	15364542.00	15364542.00
Vellarimala High School back side road	1.586	0.33	15364542.00	5008840.69
Chooralmala to attamala	2.500	1.00	15364542.00	15364542.00
Town road	1.270	1.27	15364542.00	19512968.34
Village road	2.171	0.40	15364542.00	6145816.80
Estate road	0.583	0.58	15364542.00	8957527.99
Mandakai punchirimattom estate road	0.200	0.20	153,645,42.00	3072908.40
SH Meppadi Chooralamala	1			
Total	**14.09**	**7.98**		**123,076,249.53**

Severe damage			Moderate Damage			Remarks
		30 to 70 %			below 30%	
Length in km	Cost /Km	Total cost	Length in km	Cost /Km	Total cost	
0.75	12967137	9725352.75	0.750	10514014	7885510.5	Total damage cost includes for both 3.5m & 3.80m carriageway road with GSB = 20cm WMM =15cm and MSS = 2cm and drain on both sides. In severe damage cost of GSB is not included and in moderate damage GSB and WMM are not included. See PDF attached for rates.
				10424178		
				10424178		
				10424178		
				10424178		
0.15	12683631	1902544.65		10424178		
				10424178	0	
0.8	12683631	10146904.8	0.700	10424178	7296924.6	
		0		10424178		
	12683631	0		10424178		
				10424178		
				10424178		
			1	12138000	12138000	Only DBM surface damage considered
1.7		**217,748,02.2**	**1.450**		**151,824,35.1**	

Annexure 2: 9.2 Damage of concrete road

Damage of Concrete Road				
	Total Damage			Remarks
Name of road	Length in km	Cost /Km	Total cost	
Vellarimala High School back side road	1.26	19515543	24589584.18	Rate Includes GSB =20cm DLC=10cm and PQC=15cm
village road	1.771	19515543	34562026.65	
Total Damage to Concrete Road	**3.031**	**Km**	**59,151,610.83**	

Total Damage to Concrete Road= 219,185,097.67

Annexure 3: 9.3 Damage of Box culvert and DR retaining wall

Box culvert				
Description	Number	Cost for Each	Total	Remarks
Box culvert 2 x 2, L=10m	7	612000	4,284,000.00	DR masonry for 5m ht. See PDF attached for rates.
DR Retaining wall				
Description	Length in m	Cost/m	Total	Remarks
DR Retaining wall in Attamala Road	100	87099.82	8,709,982.00	DR masonry for 5m ht. See PDF attached for rates.

Annexure 4: 9.4 Total damage to road and bridges

Description	Length in m	Total cost	Remarks
Chooralmala	30	17650000	Width is assumed as 5.50m. See attached PDF for rates.
Puchirimattom	24	17150000	
LP school	20	15860000	
Pedestrian Bridge	15	1500000	Assumption width 1.5m
		52,160,000.00	
Total Damage to Road & Bridge=		284100000	

Annexure 5: 9.5 Cost of steel girder bridge

Steel girder Bridge			
Length	80m		
width	5.5m		
steel girder weight	2.67 Tone/m		
total Weight for 80m	80 x2.67	213.6	Ton
Rate of Steel girder including installation charge	175/KG		
Cost of Steel girder including installation charge	213600 x 175	**37380000**	**Rs**
Rate for Duck Slab RCC M35	8702		
Duck slab Quantity	1x 80x5.5x 0.22=	96.8	M3
Cost of Duck Slab	**842353.6**	**INR**	
Reinforcement for slab	@200Kg/m3	19360	KG
Rate for Steel	88727	/Mt	
Cost of Steel	**17177547.2**	**INR**	
Foundation M35	2 x 7.5 x 7.5 x3	337.5	M3
Reinforcement for Foundation	@200Kg/m3	67500	KG
Rate for Steel	88727	/Mt	
Cost of Steel	**59890725**	**INR**	
Total	**115,290,625.80**		

Annexure 6: 9.6 Cost of reconstruction of roads

Reconstruction of Roads				
For arriving the market cost 120% of the DSoR rate is adopted				
Description	**Length in km**	**Cost/Km**	**Amount in INR**	**Remarks**
Chooralmala Mundakkai	2.500	31145000	77862500	Except the state highway all roads have been considered with 3.80m wide carriageway drainage. See PDF for detailed estimates.
Mundakkai Punchirimattom estate road	1.000	30375000	30375000	
Vellarimala High School back side road	1.586	30375000	48174750	
SH meppadi chooralamala	1.000	12138000	12138000	
attamala	2.500	30375000	75937500	
village road	1.000	30375000	30375000	
Total Road Reconstruction Amount	9.586	Total =	274862750	
			Market Cost in INR=	**329,835,300.00**

Annexure 7: 9.7 Cost of reconstruction of culverts

Reconstruction of Culverts				
For arriving the market cost 120% of the DSoR rate is adopted				
Description	**Number**	**Cost for Each**	**Total**	**Market Cost in INR**
Box culvert 2 x 2, L=6m	7	612000	4284000	5,140,800.00

Annexure 8: 9.8 Cost of reconstruction of culverts

Reconstruction of Bridge					
For arriving the market cost 120% of the DSoR rate is adopted					
Description	**Length in meter**	**Cost/sqm**	**Amount**	**Remarks**	
Bridge at Chooralmala	100	343,279.60	411,935,519.00	As this area is prone to landslides with heavy boulders bridge without intermediate supports are proposed. See PDF for the detailed estimates.	
Steel Girder Bridge B/W Mundakkai and Punchirimattom	80	262,024.15	115,290,625.80		
Amount for the Reconstruction of the bridge in INR		Total =	527,226,144.80	Market Cost in INR=	632,671,373.76

Annexure 9: 9.9 Recovery cost of Meppadi Chooralmala road

Utility Duct along the Meppadi Chooralmala Road					
For arriving the market cost 120% of the DSoR rate is adopted					
Description	**Length in Km**	**Cost/km**	**Amount**	**Market Cost in INR**	**Remarks**
Utility Duct along the Meppadi Chooralmala	12.4	5,291,129.03	65,610,000.00	**78,732,000.00**	Additional work provided for cable duct. See PDF for detailed estimate.
Utility Duct along the Meppadi Chooralmala Road					
For arriving the market cost 120% of the DSoR rate is adopted					
Description	**Length in m**	**Cost/m**	**Amount**	**Market Cost in INR**	**Remarks**
Pedestrian Bridge at Puthumala	80	312,500.00	25,000,000.00	**30,000,000.00**	Pedestrian bridge of 1.2m proposed for evacuation.
			Total		
Gabion Retaining wall along Meppadi Chooralmala Road					
For arriving the market cost 120% of the DSoR rate is adopted					
Description	**Length in m**	**Cost/m**	**Amount**	**Market Cost in INR**	**Remarks**
Gabion 6m	215	78506	16878790	20254548	Provided along Meppadi Chooralmala road at places where landslides happened. See PDF for detailed estimate.
Gabion 4m	85	41489	3526565	4231878	
		Total =	20,405,355.00	**24,486,426.00**	
Meppadi Choralmala Road			133,218,426.00		

Annexure 10: 9.10 Approach Road and Internal Roads for Proposed Township

For arriving the market cost 120% of the DSoR rate is adopted					
Description	**Length in km**	**Cost/km**	**Amount**	**Market Cost in INR**	**Remarks**
Approach Road	5	59,360,000.00	296,800,000.00	356,160,000.00	For approach road 5.5m carriageway and for internal road 3.80m carriageway is proposed with drain cum duct and cycle tracks. See PDF for detailed estimate
Internal Roads	15	58,326,666.67	874,900,000.00	1,049,880,000.00	
Total =			1,171,700,000.00	**1,406,040,000.00**	

Annexure 11: 9.11 Cost of construction of helipad

For arriving the market cost 120% of the DSoR rate is adopted			
Description	**Amount as per DSoR**	**Market Cost in INR**	**Remarks**
Helipad	78,610,000.00	**94,332,000.00**	2 nos. of 30m dia Helipads with approach road of 2 km of 5.5m provided. See PDF for detailed estimate.

Power

Annexure 1: 10.1

Office Order (DF) No.237/2024 (TRAC/R2/GL/Cost Data-2024/23-24) dated 12.02.2024

Cost Data of distribution works approved by the Commission for KSEB Limited w.e.f 08.02.2024		
Abstract		
Sl. No.	**Description of the work**	**Rate approved by the Commission in Rupees**
1	Providing support pole for weather proof service connection	7547
2	Post insertion for LT single phase overhead line (without stay)	8563
3	Post insertion for LT single phase overhead line (with stay)	11706
4	Post insertion for LT single phase overhead line (with strut)	16455
5	Post insertion for LT three phase overhead line (without stay)	9365
6	Post insertion for LT three phase overhead line (with stay)	12508
7	Post insertion for LT three phase overhead line (with strut)	17257
8	Shifting Single Phase Energy Meters	909
9	Shifting Three Phase Energy Meters	1195
10	Shifting Three Phase CT Meters	1792
11	HT pole insertion in HT/LT line (with stay)	18608
12	HT pole insertion in HT/LT line (with strut using 8m pole)	22208

Cost Data of distribution works approved by the Commission for KSEB Limited w.e.f 08.02.2024		
10	Shifting Three Phase CT Meters	1792
11	HT pole insertion in HT/LT line (with stay)	18608
12	HT pole insertion in HT/LT line (with strut using 8m pole)	22208
13	Providing strut using LT pole	7892
14	Providing strut using HT pole	10154
15	Providing LT stay	3143
16	Providing HT stay	4293
17	Adding one conductor (ACSR Rabbit) on the existing poles (where cross arm is not available) inclusive of cost of pin, insulator etc.	82 (per meter)
18	Conversion of 1km LT single phase 2 wire line to LT Three phase 4 wire line	180 (per meter)
19	Conversion of 1km LT single phase 2 wire line to LT Three phase 5 wire line	258 (per meter)
20	Conversion of 1km LT single phase 3 wire line to LT Three phase 5 wire line	188 (per meter)
21	Drawing 1km LT OH Line on existing poles 2 wire ACSR Rabbit	156 (per meter)
22	Drawing 1km LT OH Line on existing poles 3 wire ACSR Rabbit	229 (per meter)
23	Drawing 1km LT OH Line on existing poles 4 wire ACSR Rabbit	287 (per meter)
24	Drawing 1km LT OH Line on existing poles 5 wire ACSR Rabbit	377 (per meter)

Cost Data of distribution works approved by the Commission for KSEB Limited w.e.f 08.02.2024		
25	Constructing 1km LT OH Line 2 wire with Rabbit using PSC Poles	487 (per meter)
26	Constructing 1km LT OH Line 3 wire with Rabbit using PSC Poles	562 (per meter)
27	Constructing 1km LT OH Line 4 wire with Rabbit using PSC Poles	634 (per meter)
28	Constructing 1km LT OH Line 5 wire with Rabbit using PSC Poles	718 (per meter)
29	Constructing 1km 11kV OH Line with ACSR Raccoon using PSC Poles	966 (per meter)
30	Constructing 1km 11kV line with UG Cable 300 sq.m by open trench	2657 (per meter)
31	Constructing 1km 11kV OH Line with ACSR Raccoon using A type Poles	1500 (per meter)
32	Installation of 1 No. 11 KV/ 433 V, 100 KVA Transformer without stay (pole mounted)	490575
33	Installation of 1 No. 11 KV/ 433 V, 160 KVA Transformer without stay (pole mounted)	624092
34	Installation of 1 No.11 KV/ 433V, 250 KVA Transformer	810265
35	Installation of Data Acquisition compatible Extensible type Ring Main Unit without VCB -CCC (E) (Cable - Cable -Cable)	847800
36	Installation of Data Acquisition compatible Extensible type Ring Main Unit with VCB -CTC (E) (Cable - Transformer -Cable)	891215

Cost Data of distribution works approved by the Commission for KSEB Limited w.e.f 08.02.2024		
37	Installation of Data Acquisition compatible Extensible add-on type Ring Main Unit without VCB (Single Switch C-Extension)	429904
38	Installation of Data Acquisition compatible, Extensible, add-on type Ring Main Unit with VCB (Single Switch T-Extension)	561411
39	Installation of Data Acquisition compatible Extensible type Ring Main Unit with provision for isolation and earthing facility on both sides (gCCg)	536546
40	Drawing 1km of HT ABC of size 3X150 + 1X120 sq mm using 9 M PSC Poles	2188 (per meter)
41	Drawing 1km of HT ABC of size 3X120 + 1X95 sq mm using 9 M PSC Poles	2005 (per meter)
42	Drawing 1km of LT ABC of size 3X70 + 1X50 +1X16 sq mm using 8 M PSC Poles	819 (per meter)
43 (Old Annexure)	LT single-phase weather-proof service connection up to and including 5kW (using static meter with LCD facility)	1914
44 (Old Annex 2)	LT three phase weather proof service connection up to and including 10 KW (using static meter with LCD display and TOD facility)	4642
45 (Old Annex 3)	LT three phase weather proof service connection above 10kW up to and including 25kW (using static meter with LCD display and TOD facility)	15862
46 (Old Annex 4)	LT three phase weather proof service connection above 25kW & below 50kVA	23925

Cost Data of distribution works approved by the Commission for KSEB Limited w.e.f 08.02.2024		
47 (Old Annex 5)	LT three phase weather proof service connection from 50kVA and above up to and including 100kVA.	25300
48 (Old Annex 7)	LT single phase overhead service connection up to and including 50m with max. 1 Post	10076 + 88 per M of OH line
49 (Old Annex 8)	LT single phase overhead service connection above 50 m up to and including 100 m with max. 2 Posts	24145 + 88 per M of OH line above 50m
50 (Old Annex 9)	LT single phase overhead service connection above 100m up to and including 150m with max. 3 Posts	37895 + 88 per M of OH line above 100m
51 (Old Annex 10	LT single phase overhead service connection above 150m up to and including 200m with max. 4 Posts	1425 + 88 per M of OH line above 150m
52 (Old Annex 11)	LT three phase overhead service connection up to and including 50m with max. 1 Post	12705 + 176 per M of OH line
53 (Old Annex 12)	LT three phase overhead service connection above 50m up to and including 100m with max. 2 Posts	31680 +176 per M of OH
54 (Old Annex 13)	LT three phase overhead service connection above 100m up to and including 150m with max. 3 Posts	1260 + 176 per M of OH line above 100m
55 (Old Annex 14)	LT three phase overhead service connection above 150m up to and including 200m with max. 4 Posts	70510 + 176 per M of OH line above 150m
56(Old Annex 21)	conversion of LT single phase weatherproof service connection to LT three phase weather proof service connection with connected load up to and including 10kW	4587
57 (Old Annex 22)	conversion of LT single phase weatherproof service connection to LT three phase weather proof service connection with load above 10 kW up to and including 25kW	16995

Cost Data of distribution works approved by the Commission for KSEB Limited w.e.f 08.02.2024		
58(Old Annex 23)	conversion of LT single phase weatherproof service connection to LT three phase weather proof service connection with load above 25kW and below 50kVA	24899
59(Old Annex 24)	conversion of LT single phase weatherproof service connection to LT three phase weather proof service connection with load 50kVA and above up to and including 100kVA	26180
60(Old Annex 25)	Estimate for enhancement of connected load of LT three phase weather proof service connection with a max. load of 10kW into the range of 10 kW to 25 kW.	16005
61(Old Annex 26)	Estirriate for enhancement of connected load of LT three phase weather proof service connection with a maximum connected load of 10 kW into the range of 25 kW to 50 kVA.	24805
62(Old Annex 27)	Estimate for enhancement of connected load of LT three phase service connection with a maximum connected load of 10 kW into the range of 50 kVA to 100 kVA.	26866
63(Old Annex 28)	Estimate for enhancement of connected load of LT three phase service connection with load in the range of 10kW - 25 kW into the range 25 kW - 50kVA	20594
64(Old Annex 29)	Estimate for enhancement of connected load of LT three Phase service connection with load in the range of 10kW - 25 kW into the range of 50 kVA - 100 kVA	22098
65(Old Annex 30)	Estimate for enhancement of connected load of LT three Phase service connection with load in the range of 25kW - 50 kVA into the range of 50 kVA - 100 kVA	19905

Annexure 2: 10.2

Estimated cost does not include cost of fencing and construction of yard. Cost of weatherproof portion to be collected extra; charges for providing additional pole stays and struts if any required shall be collected extra **Note: - GST applicable to be collected as per orders issued by the Central Government and State Government** **The items on which the Hon'ble Commission had approved 10°/ increase from previousrates or the rates proposed in the petition, whichever is lower**		
Other items approved by the Hon'ble Commission		
i.	**Fencing for transformers and RMUs** Providing Transformer/RMU fencing to a height of 1.8 m above ground level using MS Angle frames of size ISA 50x50x6mm for outer frame, 2 runs of 40x6 MS flat for horizontal bracing and grills with MS rods 8 mm Dia @ 10cm c/c for verticals, providing gate with locking arrangements, providing danger board & name board, embedding the legs in cement concrete 1:2:4, footing of size 30cmx30cmx50cm, painting with synthetic enamel paint two coats over one coat of iron primer etc complete, including cost of transportation	38153
ii.	**Construction of yard for transformers** Cleaning and levelling of transformer yard, spreading 40 mm broken stone in yard for a thickness of 10 cm above bed of 10 cm thick 6 mm broken stone, after constructing a curb wall of height 20cm above ground and 10cm below level including cost of all materials and charges for conveying, spreading, consolidating etc.	23075
iii	**Construction of yard for RMUs** Cleaning and levelling of RMU yard, spreading 40 mm broken stone in yard for a thickness of 10 cm above bed of 10 cm thick 6 mm broken stone, after constructing a curb wall of height 20cm above ground and 10cm below level including cost of all materials and charges for conveying, spreading, consolidating etc.	11538
iv	**Energization charges per consumer: - Individual** consumers located inside colonies, high rise buildings or commercial/ industrial/residential complexes developed by promoters/builders wherein all internal distribution network including installation of energy meter is carried by the developer	300

Productive sector

Agriculture and Horticulture

Annexure 1: 11.1 Damage loss

Damage loss				
	DAMAGE COST ESTIMATE		**2024-25 NABARD unit cost Rs (used state cost wherever NABARD cost not available)**	**Total**
		Area (Ha)		
Perennial	**Coffee**	100	179000	17900000
	Cardamom	100	660000	66000000
	Pepper	75	225000	16875000
	Coconut	5	266000	1330000
	Areacanut	10	845000	8450000
	Fruit plants papaya)	30	165000	4950000
	Tea	200	400000	80000000
	Jack	10	2100000	21000000
	Nutmeg	2	511000	1022000
	Cocoa	4	127000	508000
	Mango	5	160000	800000
	Ginger	10	225000	2250000
	Banana	20	410000	8200000
	Tuber	50	220000	11000000
Annual	**Vegetables**	5	480000	2400000
	TOTAL	**626**		**242685000**

Annexure 2: 11.2 Damage to farm implements, pump sets and machineries

Damage to farm implements, pump sets and machineries			
Item	**Number**	**Unit cost in Rs**	**Total**
Weed cutter	80	25000	2000000
Sprayer	150	3000	450000
Chainsaw	18	25000	450000
Other implements	750	500	375000
Pump set and accessories	200	20000	4000000
	1198		**7275000**

Annexure 3: 11.3 Economic Loss estimate -Item wise (See *Page 572*)

ECONOMIC LOSS ESTIMATE								
Items			**Productivity kg per ha**	**Total Quantity in kg**	**Price Rs Per kg**	**Total price**	**Econ Life span (Year)**	**TOTAL**
		Area (Ha)						
Perennial	**Coffee**	100	798	79800	208.33	16624734	20	332494680
	Cardamom	100	526	52600	1866.67	98186842	7	687307894
	Pepper	75	409	30675	662.5	20322187.5	10	203221875
	Coconut (nuts)	5	6228	31140	13.16	409802.4	30	12294072
	Arecanut	10	1068	10680	195	2082600	15	31239000
	Fruit plants (Papaya)	30	5970	179100	15	2686500	2	5373000
	Tea	200	1864	372800	14.08	5249024	30	157470720
	Jack (Nos)	10	2670	26700	100	2670000	10	26700000
	Nutmeg	2	634	1268	205	259940	15	3899100
	Cocoa	4	1284	5136	30	154080	10	1540800
	Mango	5	6206	31030	30	930900	10	9309000
Annual	**Ginger**	10	4479	44790	98	4389420		0
	Banana	20	9432	188640	32.33	6098731.2		0
	Tuber (Tapioca)	50	47127	2356350	15.66	36900441		0
	Vegetables	5	939	4695	39.5	185452.5		0
	TOTAL	**626**		**3415404**				**1470850141**

Annexure 4: 11.4 Overall Economic Loss Estimate in Crore (Stored products) - Agriculture

Item	Quantity (kg)	Price Rs per kg	Total Damage Estimate	-
Coffee	7000	208.33	1458310	0.145831
Cardamom	60	2000	120000	0.012
Pepper	6000	662.5	3975000	0.3975
Arecanut	3000	222	666000	0.0666
Turmeric	12	150	1800	0.00018
-	-	-	6221110	0.622111

Annexure 5: 11.5 Recovery Cost estimate

Formation of FIGs and other activities through Kerala Agro Business Company (KABCO)				
Sl. No	**Particulars**	**Unit Cost (INR in lakhs)**	**Area /Quantity /Agency**	**Amount**
1	Formation of FIGs and other activities through Kerala Agro Business Company (KABCO)	200	KABCO	200
	Engaging Handholding agency for formation of FIGs for 3 years.			
	Handholding agencies to perform:			
	1. Organising farmers and giving awareness			
	2.Feasibility studies			
	3.Bussiness Plan preparation of FPO/FCs			
	4. CFC formation			
	5. Value chain and marketing programs			
	6. Conduct B2B conclave			
	7. Other relevant activities related to FPO/ FC formation.	0.1	150 nos.	15
	8. Working capital			
2	Homestead cultivation in 5 cents	0.05	150 nos.	7.5
	1. Cultivation of Coconut, Banana, medicinal plants etc.			
3	Cultivation of Vegetables (10 acre)	2.50/acre for 1 season	10 cares for 3 seasons	40
	1.By precision farming and modern technologies			

Formation of FIGs and other activities through Kerala Agro Business Company (KABCO)				
Sl. No	**Particulars**	**Unit Cost (INR in lakhs)**	**Area /Quantity /Agency**	**Amount**
4	Coffee plantation (15 acre) Irrigation facilities Maintenance	1.0/acre 0.75/acre 0.45/acre	15 acres	15 11.25 6.75
5	Exotic Fruits and Traditional deep-rooted plants	0.045/acre	15 acres	0.675
	Maintenance	0.02/acre		
				0.3
6	Nursery Preparation	3.00/acre	1 acre	3
	Maintenance	2.00/acre		2
7	Poly House	0.02/sq. m.	400 sq. m.	8
	Seeds and seedlings & maintenance	0.01/sq. m.		4
	Mushroom Unit	0.05/unit	10 nos.	5
8	CFC & Value addition building,	2000/unit	1 no	2000
	Machinery etc.			
9	Marketing Centre	50	1	50
10	Mini Weather Station	2.5/unit	1	2.5
	Maintenance (5 years)	0.50/year	5 years	2.5
11	Bamboo and Bio Char (2 acres) unit-gaseous technology unit	10	1 unit	10
12	Hydroponics (2 nos.)	10	2 nos.	20
13	Micro green Units	5	2 nos.	10
14	Vermi compost units	0.6	4 nos.	2.4
15	Contingency fund	5%		120.79
	Total			2536.67

Animal Husbandry and Dairy development

Annexure 1: 12.1 Livelihood support program for including in the proposed Wayanad township

Sl. No.	SCHEME	OUTLAY (Lakh INR)
1	Establishment of satellite piggery units in Wayanad as a part of Rebuild Wayanad Programme	165.75
2	Establishment of satellite goat units in Wayanad as a part of Rebuild Wayanad Programme	140.00
	Total	**305.75**

Annexure 2: 12.2 Pig breeding program

Component	Rate (INR)	Fund Required (INR in Lakhs)
Distribution of piglets 50 numbers of satellite breeding units to farmers 9 female F1 cross & 1 male Duroc in one year	@ 12000 @18000	54.00 9.00
Support for improving housing facilities at farmers level SBU (50 units)	0.50 lakh/ SBU	25.00
Establishment of Biogas Plant- 2m3 (50 SBU)	25000/m3	25.00
Construction of Slurry tank – 2 m3 (50 SBU)	10000/m3	10.00
Compost Pit – 2 m3	7500/m3	7.50
Strengthening of training infrastructure at PBC		3.00
Training to farmers	@ 3500/-	1.75
Vaccination to the breeding stock	100/- animal	0.50
Administrative/Operational expenses		30.00
Total		**165.75**

Annexure 3: 12.3 Goat breeding program

Sl. No.	Components	Rate (in INR)	Quantity required	Amount (INR in lakhs)
1	Cost of animal's units with 10 females each	11000	500	55
2	Goats shed	100000	50	50
3	Goat feed @20 kg per unit for 20 months	INR 35/- per kg	12000	4.20
4	Administrative supervisory and other incidental	LS		30.80
	Total			**140.00**

Cross Cutting

Disaster Risk Reduction

Annexure 1: 15.1

Checklist recommended by expert advisory committee constituted vide GO (Rt) No. 664/2018/DMD dated 30-11-2018 to study the construction of houses in landslide hazard prone areas

Hazard Susceptibility checklist to be considered before issuing permits in landslide/ debris flow prone areas by Local Governments

അനുബന്ധം 1: ഉരുൾപൊട്ടൽ/മണ്ണിടിച്ചിൽ സാധ്യതാ മേഖലയിൽ വീടുകളുടെയും കെട്ടിടങ്ങളുടെയും പെർമിറ്റിനുള്ള ദുരന്ത സാധ്യതാ അവലോകന ചെക്ക്ലിസ്റ്റ്

This checklist should be filled by the District Geologist (his/her representative) and the Engineer of the concerned Local Government prior to issuing construction permit in debris flow/landslide prone local governments.

ഉരുൾപൊട്ടൽ/മണ്ണിടിച്ചിൽ സാധ്യതാ മേഖലയിൽ വീടുകളുടെയും കെട്ടിടങ്ങളുടെയും പെർമിറ്റ് നൽകുന്നതിന് മുൻപ് തദേശ സ്വയംഭരണ സ്ഥാപനങ്ങൾ അതാത് ജില്ലയിലെ ജില്ലാ ജിയോളജിസ്റ്റ് (അല്ലെങ്കിൽ പ്രതിനിധി), തദേശ സ്ഥാപനത്തിൻറെ എഞ്ചിനീയർ എന്നിവരെ ഉപയോഗിച്ച് സംയുക്തമായി പരിശോധന നടത്തിച്ച് ഈ ചെക്ക്ലിസ്റ്റ് പൂരിപ്പിച്ച് ശുപാർശ വങ്ങേണ്ടതാണ്.

All questions should be answered. If the minimum score against all the questions is summed, the total score will be 20 and if the maximum scores are summed, it will be 100. If the total score arrived at for a given construction plot is greater than 35, permits may be issued.

എല്ലാ ചോദ്യങ്ങൾക്കും ഉത്തരം രേഖപ്പെടുത്തേണ്ടതാണ്. ഓരോ ഉത്തരത്തിനും ബ്രാക്കറ്റിൽ ഉള്ള നമ്പർ കൂട്ടിയാൽ കിട്ടുന്ന ഏറ്റവും ചുരുങ്ങിയ സ്കോർ 20 ആണ്. ഏറ്റവും കൂടുതൽ സ്കോർ 100 ആണ്. പരിശോധനയ്ക്ക് ശേഷം പ്രസ്തുത സ്ഥലത്തിന് മൊത്തം ലഭിക്കുന്ന സ്കോർ 35ൽ കൂടുതൽ ആണെങ്കിൽ മാത്രമേ വീട് നിർമ്മാണത്തിന് പരിഗണിക്കാൻ പാടുള്ളൂ.

If the answers to questions 2 and 3 are 'Yes', construction in the said site shall not be permitted at all.

ചോദ്യം രണ്ട്, മൂന്ന് എന്നിവയിൽ ഏതെങ്കിലും ഒന്നിൻറെ ഉത്തരം 'അതെ' എന്നാണെങ്കിൽ ഒരു കാരണവശാലും വീട് നിർമിക്കുവാൻ അനുവദിക്കരുത്.

I. Is the proposed site of construction in high, moderate or low landslide susceptible zone as marked in the landslide susceptibility map of Centre for Earth Science Studies?

വീടിനായി നിർണയിച്ചിരിക്കുന്ന സ്ഥാനം ഭൌമ ശാസ്ത്ര പഠന കേന്ദ്രം (Centre for Earth Science Studies) തയ്യാറാക്കിയ ഉരുൾപൊട്ടൽ/മണ്ണിടിച്ചിൽ സാധ്യതാ ഭൂപടത്തിൽ 'ഹൈ, മോഡറേറ്റ്, ലോ, സാധ്യതാ പ്രദേശത്ത് അല്ല' എന്നിവയിൽ ഏതു പ്രദേശത്ത് ആണ്?

ഹൈ High (1), മോഡറേറ്റ് Moderate (2), ലോ Low (6), സാധ്യതാ പ്രദേശത്ത് അല്ല Not in landslide susceptible site(10)

II. Is the propose site of construction in a plot where landslide/debris flow occurred in 2018?

വീടിനായി നിർണയിച്ചിരിക്കുന്ന സ്ഥാനം 2018ലെ കാലവർഷത്തിൽ ഉരുൾപൊട്ടൽ/മണ്ണിടിച്ചിൽ ബാധിച്ച സ്ഥലം ആണോ?

അതെ Yes (0)/അല്ല No (8) (If the answer is YES, permit shall not be issued. അതെ എന്നാണ് ഉത്തരം എങ്കിൽ ഒരു കാരണവശാലും വീട് നിർമിക്കുവാൻ അനുവദിക്കുവാൻ സാധിക്കില്ല)

III. Is the site listed by Geological Survey of India after the 2018 landslides as a site not suitable for construction?

വീടിനായി നിർണയിച്ചിരിക്കുന്ന സ്ഥാനം 2018ലെ കാലവർഷത്തിൽ ഉരുൾപൊട്ടൽ/മണ്ണിടിച്ചിൽ ബാധിച്ചതിനാൽ വീട് വയ്ക്കരുത് എന്ന് കേന്ദ്ര ജിയോളജി വകുപ്പ് (GSI) നിർണയിച്ചിട്ടുള്ള സ്ഥാനം ആണോ?

അതെ Yes (0)/അല്ല No (7) (If the answer is YES, permit shall not be issued. അതെ എന്നാണ് ഉത്തരം എങ്കിൽ ഒരു കാരണവശാലും വീട് നിർമിക്കുവാൻ അനുവദിക്കുവാൻ സാധിക്കില്ല)

IV. Is the slope of the plot greater than 22 deg?

വീടിനായി നിർണയിച്ചിരിക്കുന്ന സ്ഥാനത്തിൻറെ ചരിവ് 22 ഡിഗ്രീയിൽ കൂടുതൽ ആണോ?

അതെ Yes (0)/അല്ല No

V. Is the upper slope of the plot having a vertically overhanging cut-slope which is having a height of greater than 1 meter?

വീടിനായി നിർണയിച്ചിരിക്കുന്ന സ്ഥാനത്തിൻറെ മേൽഭാഗത്തെ ചരിവ് 1 മീറ്ററിൽ കൂടുതൽ വെട്ടി കിഴക്കാം തൂക്കായി നിർത്തിയിട്ടുണ്ടോ?

ഉണ്ട് Yes (2)/ഇല്ല No (6)

VI. Are there residual debris of previous landslides/debris flows or large loose rock boulders in the upper slope of the plot proposed for construction?

വീടിനായി നിർണയിച്ചിരിക്കുന്ന സ്ഥാനത്തിൻറെ മേൽഭാഗത്തെ ചരിവിൽ, വീടിൻറെ സ്ഥാനത്ത് വന്ന് പതിക്കാവുന്ന രീതിയിൽ വലിയ പാറകൾ/ഒഴുകി ഇറങ്ങാവുന്ന രീതിയിൽ മണ്ണ്/ഇടിഞ്ഞ് ഇറങ്ങാവുന്ന രീതിയിൽ മണ്ണ്/മുൻ ഉരുൾപൊട്ടൽ/മണ്ണിടിച്ചിൽ എന്നിവയുടെ ബാക്കി എന്നിവ ഉണ്ടോ?

ഉണ്ട് Yes (2)/ഇല്ല No (6)

VII. Is the lower side of the proposed plot for construction having a vertical cutslope of greater than 1 meter such that if the cutslope fails that it may impact the foundation of the constructed building?

വീടിനായി നിർണയിച്ചിരിക്കുന്ന സ്ഥാനത്തിൻറെ താഴ്ഭാഗത്തെ ചരിവിൽ ഇടിഞ്ഞ് വീണാൽ വീടിൻറെ അടിത്തറയെ ബാധിക്കാവുന്ന രീതിയിൽ 1 മീറ്ററിൽ കൂടുതൽ മണ്ണ് വെട്ടി കിഴക്കാം തൂക്കായി നിർത്തിയിട്ടുണ്ടോ?

ഉണ്ട് Yes (2)/ഇല്ല No (6)

VIII. Is it feasible to terrace the upslope and downslope of the proposed plot for construction with not more than 1 meter height?

വീടിനായി നിർണയിച്ചിരിക്കുന്ന സ്ഥാനത്തിൻറെ മേൽഭാഗത്തെ ചരിവും, താഴ്ഭാഗത്തെ ചരിവും 1 മീറ്റർ ഉയരത്തിൽ അധികരിക്കാതെ തട്ടുകളായി തിരിക്കുവാൻ സാധിക്കുമോ?

സാധിക്കില്ല Can be terraced (2)/സാധിക്കും Space insufficient to terrace (8)

IX. Is soil piping noticed at the proposed plot for construction or its immediate upslope or downslope?

വീടിനായി നിർണയിച്ചിരിക്കുന്ന സ്ഥാനത്ത് കുഴലീകൃത മണ്ണൊലിപ്പ് (Soil Piping) ശ്രദ്ധയിൽ പെട്ടിട്ട് ഉണ്ടോ?
ഉണ്ട് Yes (2)/ഇല്ല No (6)

X. Is the plot proposed for construction within 15 meters from the nearest hill rivulet/hill stream?

വീട്/കെട്ടിടത്തിനായി നിർണയിച്ചിരിക്കുന്ന സ്ഥാനം തൊട്ടടുത്തുള്ള നീർച്ചാലിൽ നിന്നും 15 മീറ്ററിനുള്ളിൽ ആണോ?

അതെ Yes (2)/അല്ല No (8)

XI. Is the upslope of the proposed plot for construction a reserved forest, degraded forest due to forest fire or tree felling?

വീട്/കെട്ടിട നിർമ്മാണം നടത്താൻ ഉദ്ദേശിക്കുന്ന സ്ഥലത്തിൻറെ മുകൾ ഭാഗത്ത് റിസർവ് വനം ആണോ, കാട്ടുതീ, മരം മുറിച്ചു മാറ്റൽ എന്നിവ മൂലം ക്ഷയിച്ച വനമേഖലയാണോ?

ക്ഷയിച്ച വനം Degraded Forest (2)/റിസർവ് വനം Reserve Forest (7)

XII. Has the plot proposed for construction ever been affected by landslides/debris flows in the known history?

വീടിനായി/കെട്ടിടതിനായി നിർണയിച്ചിരിക്കുന്ന സ്ഥാനത്ത് മുൻവർഷങ്ങളിൽ മലയിടിച്ചിൽ ഉണ്ടായിട്ടുണ്ടോ?

ഉണ്ട് Yes (2)/ഇല്ല No (6)

XIII. Is the inclination of the contact between the eroded strata and bed rock in the upslope of the proposed plot for construction towards the site of construction?

ദ്രവിച്ച പാറയേയും ഉറച്ച ശിലയെയും വേർതിരിക്കുന്ന പ്രതലത്തിൻറെ ചരിവ്/ദിശ വീട്/കെട്ടിടം നിർമിക്കുന്ന സ്ഥലത്തേക്കാണോ അഭിമുഖീകരിക്കുന്നത്?

അതെ Yes (2)/അല്ല No (8)

XIV. Are there deep or visible crevasse on the plot proposed for construction?

വീടിനായി/കെട്ടിടതിനായി നിർണയിച്ചിരിക്കുന്ന സ്ഥാനത്ത് മണ്ണിൽ ആഴത്തിൽ ഉള്ള വിള്ളലുകൾ ഉണ്ടോ?
ഉണ്ട് Yes (2)/ഇല്ല No (7)

XV. What is the total score of the plot proposed for construction based on the answers to the above questions?

മേൽ ഉത്തരങ്ങളുടെ വെളിച്ചത്തിൽ വീടിനായി നിർണയിച്ചിരിക്കുന്ന സ്ഥാനത്തിന് ലഭിച്ച മൊത്തം സ്കോർ എത്ര?

XVI. Can construction be permitted in the proposed plot?

വീട്/കെട്ടിടം നിർമ്മാണം അനുവദിക്കാമോ?

അനുവദിക്കാം/അനുവദിക്കാൻ പാടില്ല

XVII. Record special remarks, if any

പ്രത്യേക ശുപാർശകൾ ഉണ്ടെങ്കിൽ രേഖപ്പെടുത്തുക.

The landslide susceptibility map is available in http://sdma.kerala.gov.in/maps/ which can be downloaded and used in Google Earth. After downloading the KMZ file of the landslide susceptibility map of the concerned

district and opening in the Google Earth software, the corner locations of the proposed plot for construction shall be located on it using the Place Mark tool to examine the susceptibility of the plot.

മണ്ണിടിച്ചിൽ, ഉരുൾപൊട്ടൽ സാധ്യതാമേഖലാ ഭൂപടം http://sdma.kerala.gov.in/maps/ എന്ന ലിങ്കിൽ ലഭ്യമാണ്. ഗൂഗിൾ എർത്തിൽ ഉപയോഗത്തിനായി ഗങദ ഫയലുകൾ ഇവിടെയുള്ള ദകജ ഫയൽ ഡൌൺലോഡ് ചെയ്തതിന് ശേഷം എക്സ്ട്രാക്റ്റ് ചെയ്യുക. അപ്പോൾ ജില്ല തിരിച്ച് ഗങദ ഫയലുകൾ ലഭിക്കും. ഈ ഫയൽ ഗൂഗിൾ എർത്തിൽ തുറന്ന്, വീടിനായി നിർണയിച്ചിരിക്കുന്ന സ്ഥാനത്തിൻറെ അതിരുകളുടെ അക്ഷാംശ രേഖാംശ വിവരം ഇതിൽ പ്ലോട്ട് ചെയ്താൽ ഈ വിവരം കൃത്യമായി കണ്ടെത്താം.

If the proposed site has a slope of greater than 22 degree it is advisable that construction is permitted only 15 meters away from the nearest rivulet. If the owner of the plot do not have any other site satisfying this condition, the construction should be permitted as far away as possible from the nearest rivulet.

വീടിനായി നിർണയിച്ചിരിക്കുന്ന സ്ഥാനം 22 ഡിഗ്രീയിൽ കൂടുതൽ ചരിവ് ഉള്ളത് ആണെങ്കിൽ, അത്തരം സ്ഥലങ്ങളിൽ വീട് നിർമ്മാണത്തിന് തൊട്ടടുത്തുള്ള നീർച്ചാലിൽ നിന്നും ചുരുങ്ങിയത് 15 മീറ്റർ എങ്കിലും അകലം പാലിക്കുന്നത് ഉചിതമാണ്. എന്നാൽ വീട്ടുടമയുടെ സ്ഥല ലഭ്യതയ്ക്ക് അനുസരിച്ച്, ഇത്തരം സ്ഥലം ലഭ്യമല്ലെങ്കിൽ, വീട് വയ്ക്കുന്നത് നീർച്ചാലിൽ നിന്നും സാധ്യമായ പരമാവധി അകലത്തിൽ ആയിരിക്കണം എന്ന് നിർദേശിക്കുക.

Annexure 2: 15.2

Terms of Reference for examining land use contributions to increasing risks in Kerala

Kerala State Disaster Management Authority

Kerala is a state highly vulnerable to natural disasters and the changing climatic dynamics given its location along the sea coast and with a steep gradient along the slopes of the Western Ghats. Kerala is also one of the most densely populated Indian states (860 persons per square kilometres) which makes it even more vulnerable to damages and losses on account of disasters. Floods are the most common of natural hazards that affects the State. Nearly 14.5% of the State's land area is prone to floods, and the proportion is as high as 50% for certain districts. The State lies in seismic zone III which corresponds to Moderate Damage Risk Zone (MSK VII). The State falls under Moderate Damage Risk Zone for Wind and Cyclone (Vb=39 m/s). As per IMD data for the period 1877-2005, the state witnessed six cyclonic storms and five severe cyclonic storms. The state also witnesses high incidence of lightning, especially in the months of April, May, October and November. Lightning strikes cause heavy loss of lives in the State.

Landslides are a major hazard along the Western Ghats in Wayanad, Kozhikode, Idukki and Kottayam districts (as seen in the weather led disaster that occurred in 2018). The western flank of the Western Ghats covering the eastern part of Kerala is one of the major landslide prone areas of the country. 1500 sq.km in the Western Ghats is vulnerable and every year with the onset of monsoon landslides are reported. The mountain regions experience several landslides during the monsoon season (Kuriakose, 2010) leading to road collapse, silting of river beds and creating heavy damages on public and private assets. 14.8% of the state is prone to flooding (CESS, 2010). The coastline is prone to erosion, monsoon storm surges and sea level rise. Land subsidence due to tunnel erosion or soil piping is a slow hazard that has recently been affecting hilly areas.

The coast line of Kerala (590 km) is one of the most densely populated land areas in the country. More than half of the area of the State is only 4 meters above sea-level and encroachment by the sea severely affects the economy of the State. A substantial part of population not only lives close to the coastline but also lives off it and they belong to the vulnerable sections of the society. This coastline is exposed to high waves, storm surges and Tsunamis. Sea erosion is one of the recurring natural hazards affecting the coastline in the State, as part of the erosion - accretion cycle. It is feared that with the predicted rise in sea level, as a result of the greenhouse gas effect, the rate of beach erosion and loss of coastal properties are on the rise. The state has taken efforts to reduce the erosion with multiple interventions such as coastal sea walls, breakwaters/spurs jetting into the sea, under water sand filled geo-textile tubes to reduce the intensity of the waves, etc. Coastal erosion has resulted in loss of life and property of the coastal fisher-population who are among the most economically backward communities in the State.Apart from loss of lives, hundreds of houses and public infrastructure are damaged due to the fury of the sea. Almost all fisher families prefer to live along the coast and very few of them tend to have landed property or houses further inland. Therefore, their vulnerability to the vagaries of sea waves and magnitude of the following disasters have been increasing, damaging livelihoods and properties of the fishermen community.

Kerala experiences seasonal drought conditions every year during summer months. Kerala experienced 66 drought years between 1881 and 2000. More than 50% of Kerala's land area is moderately to severely drought susceptible. After the drought years of 2002-2004, 2010, and 2012, Kerala State was officially mapped as mild to moderately arid by the Indian Meteorological Department (IMD). In 2017, the IMD stated that the year brought the worst drought in 115 years. Increasing incidence of drought is mainly due to weather anomalies, change in land use, traditional practices and lifestyle of people.

Other natural hazards faced by the states includes forest fires, soil piping, swell waves and tsunami. Almost three-quarters of the population lives in urban areas, urban sprawls and fast urbanizing rural

areas. Kerala's mountainous topography and hydrological features increase their vulnerability to natural hazards. Communities regularly face low-severity, high-frequency disasters such as floods, rains, landslides, flash floods due to intense precipitation and mudflows. Many rural households whose male heads are working abroad are vulnerable, although household members left behind have mobility, but interrupted exposure to disaster-related information and limited participation in community awareness-raising activities and training.

With high density of population and major establishments along the sea coasts, large investments are required to undertake protection measures and other mitigating measures, based on scientific data.

The heavy monsoon of 2018 brought widespread flooding to several districts of Kerala state and triggered a large number of small to big landslides. The extreme and prolonged rainfall spell in August 2018 led to the worst flooding in Kerala in nearly a century impacting almost 5.4 million people - one-sixth of the State's population. Several districts were inundated for more than two weeks due to heavy rains induced floods. The torrential rains triggered several landslides and forced the release of excess water from 37 dams across the State, adding to the impact of floods. Nearly 341 major landslides were reported from 10 districts. Idukki district was ravaged by 143 landslides. 1,260 out of 1,664 villages spread across its 14 districts were affected. Seven districts were worst hit: Alappuzha, Ernakulam, Idukki, Kottayam, Pathanamthitha, Thrissur and Wayanad where the whole district was notified as flood affected. The devastating incident delivered a total of 435 casualties, with 6,85,000 families being affected with loss of assets and property forcing them to temporarily move to relief camps during the peak of the disaster. The Government conducted timely and efficient rescue and relief operations to save many lives, heavily supported by affected communities mobilizing on their own, and effective application of information technology and social media by voluntary youth groups to support rescue operations. The people of Kerala also showed remarkable resilience in the face of the adversity to the extent that within one week of flood waters receding, most people returned to their homes to rebuild their lives.

Risks in the State

Disasters are awakening calls leading to detailed analysis of the causes and forecasts. KSDMA in its Disaster Management Plan (DMP) has identified 39 hazards that the State is susceptible to. These were categorized under two broad heads i.e. Naturally Triggered Hazards (Natural Hazards) and Anthropogenically Triggered Hazards (Anthropogenic Hazards).

Disaster risks are exacerbated by a critical factor that has been silently and drastically changing in the State, which is the land use pattern and practices. Land use regulations are spread across multiple, incongruent acts, orders and rules. All these orders do not ideate into a single land management policy/regulation for enforcement agencies to pursue. A commonality of law for land use is absent, due to which business and habitation zones has overlapped over the years, leading to establishment of compelling public infrastructure to service these areas. This is further compounded by high density of population of 860 people/km2 (2011 Census), narrow roads, dense and intrinsic road network, density of coastal population and the general higher standard of living of the public as compared to the rest of the country.

Changing climatic conditions, unsustainable exploitation of natural resources, lack of awareness of disaster risks, inadequate hazard detection infrastructure by central agencies and nationally laid protocols respectively and slow roll out of civil defence compound to increasing the vulnerabilities. These factors, combined with limited consideration of disaster risk within social and economic sectors, because of competing demands on limited land availability, underpin the high disaster risk levels in Kerala.

The widespread flooding in urban and semi-urban areas of Kerala has reaffirmed absence of risk-informed urban planning, non-compliance to design standards, and non-incorporation of resilient features in urban infrastructure. Rapid urbanization influenced habitations into uncontrolled expansion on both banks of the rivers/water bodies thereby encroaching into water channels/bodies and constricting the floodplains. Inadequate storm water drainage and silting of minor storage ponds and flood plains in urban and urban sprawl areas have increased flood risks. Urban master plans are still awaiting comments and feedback from the local bodies to enable review/appropriate rectification and issue of notification of approval of the master plans for the respective local bodies.

Changing climate

The impacts of climate change are largely present through increases in the intensity and frequency of extreme weather events, unpredictability of precipitation, and changes to water regimes and peak seasonal runoff, caused in part by erratic precipitation, and rising temperatures. The state has also had its share of droughts with critical droughts in the years of 2013, and winters of 2017. These impacts are aggravated by lack of risk informed planning of the state. Another impact being witnessed is progressive coastal erosion affecting nearly 63% of the state's 580 kms coastline.

Disaster risk information: KSDMA, for the first time in the history of any SDMAs in the country, released landslide and flood susceptibility maps of Kerala in Geoinformation file formats for public use in its website. This has adequately empowered public to deal with risk informed environmental litigations. The State Disaster Management Plan has stipulated restrictions in hazard zones and have laid checklists for risk assessment, to be followed by the implementing department prior to approving any infrastructure development projects.

Way forward

The Floods 2018 presented an opportunity to Kerala to accelerate implementation of priority actions and risks from Centrally notified and State notified disasters. The broad activities that may be undertaken are broadly detailed as follows:

Risk Identification and Technical Studies

i) Land use categorization studies

ii) Comprehensive 1:10,000 scale land use mapping and terrain linked land use zoning

iii) Detailed state wide vulnerability assessment of critical public infrastructure and assets to site/location specific hazards

iv) Multi-hazard disaster risk mapping and impact assessments including hazard zoning and mapping high risk zones/urban areas based on protocols and methodologies laid by the concerned central agencies

v) Establishment of last mile hazard communication systems and updating of existing SOPs for triggering preparedness and emergency response actions

vi) Implementation of State-wide civil defence and capacity building for the civil defence volunteers

Risk Governance

i) Creation of a comprehensive risk informed land use plan, land use act and rules considering the ecology, sociology, and social milieu of human being are important. This may be led by Department of Planning with the help of Land use Board and Kerala State Remote Sensing and Environment Centre. Government may issue a guiding document with negotiable and non-negotiable of the preparation of the land use plan.

ii) Restriction of use of forest land for any commercial or residential or further construction activity with the exception to the existing rights of the tribal communities living in the forest areas.

iii) Land Revenue Department may be notified as the implementing and enforcement authority of the Land use plan - a reorientation and renaming of the department as Land Administration and Management may also be considered.

iv) All urban local bodies may be directed to immediately approve and notify their master plans.

v) Improve design standards for basic public services taking into consideration the multi-hazard susceptibility, flooding extent of a 1 in 30-year return interval and landslide/land subsidence events;

vi) Consider amendments to Kerala Municipal Building Rules and Kerala Panchayat Building Rules in light of National Building Code and IS Codes.

vii) Improve compliance of all new critical infrastructure projects to safer standards and specifications, and apply third party structural and safety audits to ensure compliance

viii) Increase the scope of vulnerability linked relocation plan of the State and provide incentives to constructions that comply with safety standards and have considered site specific hazard susceptibilities

ix) Development of Emergency Action Plan and update Operational & Maintenance Manuals for Dams to facilitate improved dam management

x) Formulation of a long-term Coastal Zone Disaster Mitigation Plan, a comprehensive Coastal Development funds package (as announced 2018-19 state budget) on a year-to-year basis for investments in coastal protection works/activities

Mitigation Infrastructure and Measures

i) Construction of multi-purpose emergency shelters and improved access to such shelters that are handed over to the communities with corpus fund for operation and maintenance.

ii) Contingency crop planning should be developed to deal with climate variations, to ensure sustainable livelihoods in areas of recurrent climate risks by promoting supplementary income generation

iii) Popularize crop insurance schemes

iv) Construct all new schools located in hazard-prone areas to higher standards of hazard resilience; retrofit schools in high-risk zones to increase safety; carryout technical audit of private schools, direct and provide guidance for retrofitting measures.

v) Incorporate elements of Disaster Risk Reduction in all subjects from the subject specific perspective

vi) Conduct vulnerability assessment of hospitals in hazard-prone areas, promote hazard resilient construction of new hospitals and create intrinsic and extrinsic disaster management plans for hospitals

vii) Flood mitigation options to be considered/developed comprising major works which are to be evaluated in terms of their hydraulic efficacy in delivering the required degree of flood mitigation

viii) Conduct vulnerability assessment of all critical public buildings and carryout necessary/appropriate mitigation measures to increase safety. Promote hazard resilient construction of new buildings with conformity to National Building Code

Landslides Management Strategy

i) Development of an integrated approach involving land use planning, good land management practices in cropping, grazing and forestry, terrain depended road construction, terracing and other contour-aligned practices in fields and plantations, and participation of local communities.

ii) Initiate major shift in Land use policies demarcating certain areas as 'no development zones and construction restricted zones'.

iii) Landslide hazard zonation maps to be made available in a scale (1:10,000 at least) appropriate for planning at local level for all Municipalities and Panchayats in the Hilly areas

iv) Local Self Government may be directed to consult the Soil Conservation Department, Mining and Geology Department and Ground Water Department before implementing infrastructure development projects to assess landslide risks

v) Promote the use of bio-engineering solutions along slopes to prevent landslides

Resilience in Urban and Rural Development

The following specific interventions may be considered for building urban resilience in Kerala:

i) Revise urban planning norms to conform with the hazard mapping and zoning mandatory as part of the city master plans and regulations to ensure compliance by local governments with the planning norms and guidelines

ii) Develop a guiding/policy document for preparation of Master plans with negotiables and non-negotiables, with parameters for critical mass management for urban local bodies (ULB) e.g. 600K to 800K population/ULB. The guidelines should also include identification of urban sprawl areas and measures to curtail the same be legalized in the Master plan for approval and enforcement.

iii) Develop design guidelines for climate resilient municipal infrastructure and ensuring proper enforcement for all the physical construction works to improve the quality of infrastructure being developed for municipal services.

Therefore, it is essential to undertake a study with the following objectives. The State is faced with overlapping jurisdictions on land use. At present, there exist multiple land laws which regulate the land use planning within the State. Various state departments like revenue, agriculture, forest, fisheries, and local bodies like municipal corporations etc. have their jurisdictions drawn out by separate land laws passed over the years and these departments usually come into conflict with each other when the question of overlapping jurisdiction over land arises. The dilemma can be summarized as follows:

i. Overlapping land jurisdictions hinder the reconstruction process because of the time and resources spent in determining final jurisdiction at the planning stage.

ii. Multiple laws further complicate the overall implementation process because of the complex organizational structure of authorities under which the executive power lies.

Multiple land laws create hurdles for efficient land use planning and the process of determining the authorities' in-charge of planning and reconstruction activities are entangled in legal complications. The need of the hour hence, is a comprehensive study on the existing land laws that have been put in place, followed by a consultative process to arrive at an Integrated Land Use Model that is legally optimized to enable the reconstruction process, while also clearly determining jurisdictions, the circumstances under which they may change, and a mechanism to resolve disputes over overlap.

Approach:

In pursuit of addressing the primary dilemma, we propose to study existing legislation and policy documents on land use in Kerala, to determine land jurisdiction and their surrounding conditionalities, to develop a comprehensive report on, which legislations apply to parcels of land, and under what conditions, jurisdiction may change.

Objectives:

A. To study the existing legislations on land and land use policies in Kerala including the Central government legislations which are applicable to the state of Kerala.
B. To assist in coordinating and developing a consultative process to arrive at an Integrated Land Use Policy for the state of Kerala,

Methodology:

- The research team will do the legal research of the existing land related legislations and policies.
- The team will assist KSDMA in conducting state-wide consultations with essential stakeholders.

Time frame:

- The legal study is expected to take place over 4-8 weeks.
- The draft policy document may take between 3-4 months.

Expected outcome / Deliverables:

A. A study on Land Law jurisdiction and overlap in Kerala (primary)
B. An Integrated Land Use Model (secondary)
C. Draft Policy Proposal Document

Finance and Insurance

Annexure 1: 18.1

Circular regarding insurance to disaster affected population

File No.DMA2/918/2020-DMD

"ഭരണഭാഷ- മാതൃഭാഷ"

കേരള സർക്കാർ

സംഗ്രഹം

ദുരന്ത നിവാരണ വകുപ്പ് - ദുരന്തബാധിതർക്ക് ഇൻഷുറൻസ് പരിരക്ഷ ഉറപ്പാക്കുന്നതിന് സാധ്യതാപരിശോധന, ഇതിനാവശ്യമായ ഫണ്ട് കണ്ടെത്തൽ, ഈ പദ്ധതി നടപ്പിലാക്കുന്നതിനുള്ള ഭരണപരവും ഡിജിറ്റൽ ആപ്തിലുള്ളതുമായ ചട്ടങ്ങൾ തയ്യാറാക്കൽ എന്നിവ പരിശോധിക്കുന്നതിന് കമ്മിറ്റിയെ നിയോഗിക്കുന്നതിന് അനുമതി നൽകിക്കൊണ്ട് ഉത്തരവാകുന്നു.

ദുരന്ത നിവാരണ (എ) വകുപ്പ്

സ.ഉ.(സാധാ) നം.218/2021/DMD തീയതി, തിരുവനന്തപുരം, 17/02/2021

പരാമർശം:- സംസ്ഥാന ദുരന്ത നിവാരണ അതോറിറ്റി, മെമ്പർ സെക്രട്ടറിയുടെ 16.06.2020-ലെ DM/1968/2019/SDMA നമ്പർ കത്ത്.

ഉത്തരവ്

2005- ലെ ദുരന്തനിവാരണ ആക്ടിന്റെ വകുപ്പ് 2(d)-ൽ വിവരിച്ചിട്ടുള്ള ദുരന്തങ്ങൾ നേരിടുന്നതിനും അവ ഫലപ്രദമായി കൈകാര്യം ചെയ്യുന്നതിനും അനുമായി ബന്ധപ്പെട്ട നടപടികൾ കൈകൊള്ളുന്നതിനും സംസ്ഥാന ദുരന്തനിവാരണ അതോറിറ്റിയെയും സംസ്ഥാന സർക്കാർനെയും അധികാരപ്പെടുത്തുന്ന വ്യവസ്ഥകൾ പ്രസ്തുത ആക്ടിൽ നിക്ഷിപ്തമാക്കിയിട്ടുണ്ട്. ആക്ടിന്റെ 18-ാം വകുപ്പിൽ വിവരിച്ചിട്ടുള്ള സംസ്ഥാന അതോറിറ്റിയുടെ അധികാരങ്ങളും ചുമതലകളും നിറവേറ്റുന്നതിനായി സംസ്ഥാന അതോറിറ്റിയുടെ സ്റ്റേറ്റ് എക്സിക്യൂട്ടീവ് കമ്മിറ്റിക്ക് ഒന്നോ അതിലധികമോ സബ്കമ്മിറ്റികൾ രൂപീകരിക്കാവുന്നതാണെന്നും 21-ാം വകുപ്പിൽ വ്യവസ്ഥ ചെയ്തിട്ടുണ്ട്. കമ്മിറ്റിയുടെ പരിഗണനാ വിഷയങ്ങളിൽ ഉൾപ്പെടുത്തേണ്ട risk transfer mechanism എന്ന നിലയ്ക്ക് ദുരന്തബാധിതർക്ക് ഇൻഷുറൻസ് ഏർപ്പെടുന്നതിന്റെ സാധ്യതാപരിശോധന, ഒരു ദുരന്തപ്രഖ്യാപനം വന്നു കഴിഞ്ഞാൽ/ആധികാരിക മുന്നറിയിപ്പ് ഉണ്ടായിക്കഴിഞ്ഞാൽ, മാനദണ്ഡങ്ങൾക്ക് വിധേയമായി, ദുരന്തബാധിതർക്ക് ഇൻഷുറൻസ് പരിരക്ഷ ഉറപ്പാക്കുന്നതിന്റെ സാധ്യതാപരിശോധന, ഇതിനാവശ്യമായ ഫണ്ട് കണ്ടെത്തൽ, ഈ പദ്ധതി നടപ്പിലാക്കുന്നതിനുള്ള ഭരണപരവും ഡിജിറ്റൽ രൂപത്തിലുള്ളതുമായ ചട്ടങ്ങൾ തയ്യാറാക്കൽ എന്നിവ 'ദുരന്തം' ഫലപ്രദമായി നേരിടുന്നതിന് സഹായകമാകയാൽ പ്രസ്തുത നിർദ്ദേശങ്ങൾ പരിശോധിക്കുന്നതിന് വേണ്ടിയുള്ള ഒരു കമ്മിറ്റിയെ നിയോഗിക്കുന്നത് ആവശ്യമുള്ളതായി കാണുന്നു.

2) സർക്കാർ ഇക്കാര്യം വിശദമായി പരിശോധിച്ച് ദുരന്തബാധിതർക്ക് ഇൻഷുറൻസ് പരിരക്ഷ ഉറപ്പാക്കുന്നതിന്റെ സാധ്യതാപരിശോധന, ഇതിനാവശ്യമായ ഫണ്ട് കണ്ടെത്തൽ, ഈ പദ്ധതി നടപ്പിലാക്കുന്നതിനുള്ള ഭരണപരവും ഡിജിറ്റൽ രൂപത്തിലുള്ളതുമായ ചട്ടങ്ങൾ തയ്യാറാക്കൽ എന്നിവ പരിശോധിക്കുന്നതിന് ഒരു കമ്മിറ്റി രൂപീകരിക്കുന്നതിനും ആയതിന്റെ ചെയർമാനായി പ്ലാനിംഗ് ബോർഡ് മെമ്പറായ ഡോ.കെ രവിരാമനെ നിയമിച്ചുകൊണ്ടും ചെയർമാന് ആവശ്യമായ അംഗങ്ങളെ കമ്മിറ്റിയിൽ ഉൾപ്പെടുത്താനുള്ള അനുവാദം നൽകിക്കൊണ്ടും ഉത്തരവാകുന്നു. കമ്മിറ്റിയുടെ റിപ്പോർട്ട് 2021 ഏപ്രിൽ 30 നകം സർക്കാരിൽ സമർപ്പിക്കേണ്ടതും കമ്മിറ്റിയുടെ സുഗമമായ നടത്തിപ്പിനാവശ്യമുള്ള എല്ലാ സഹായങ്ങളും സംസ്ഥാന ദുരന്ത നിവാരണ അതോറിറ്റി നൽകേണ്ടതുമാണ്.

(ഗവർണറുടെ ഉത്തരവിൻ പ്രകാരം)
ഡോ .എ .ജയതിലക് ഐ.എ.എസ്
പ്രിൻസിപ്പൽ സെക്രട്ടറി

കമീഷണർ, ലാന്റ് റവന്യൂ, തിരുവനന്തപുരം
കമീഷണർ, ദുരന്ത നിവാരണം
മെമ്പർ സെക്രട്ടറി, സംസ്ഥാന ദുരന്ത നിവാരണ അതോറിറ്റി, വികാസ് ഭവൻ പി.ഒ., തിരുവനന്തപുരം

Annexure: PDNA GO.

GOVERNMENT OF KERALA

Abstract

Disaster Management Department -Wayanad landslide 2024- Post-Disaster Needs Assessment(PDNA) Exercise at Wayanad- Expert Team Constituted- Orders Issued

DISASTER MANAGEMENT (A)DEPARTMENT

G.O.(Rt)No.625/2024/DMD Dated,Thiruvananthapuram, 23-08-2024

Read 1. GO(P) No.1/2024/DMD dated 02.08.2024.
2. MTO VII/978/2024/KSDMA dated 05.08.2024.
3. GO(P) No. 2/2024/DMD dated 09.08.2024.
4. Email dated 20.08.2024 and 22.08.2024 from National Disaster Management Authority.

ORDER

The landslide reported at Meppadi Grama Panchayath of Vythiri Taluk of Wayanad district on 30.07.2024 was declared as a notified disaster as per G.O read 1st and 3rd above. The total area of the landslide is estimated at 86,000 square meters at length of 8 kms. Ward numbers 10,11, and 12 of Meppadi Grama Panchayath were impacted and as per G.O read 3rd above these wards were notified as disaster affected. The loss of lives is currently 231 individuals and 119 individuals are still missing. In response to the situation, the Kerala State Disaster Management Authority, Government of Kerala, issued a letter- MTO VII/978/2024/SDMA-KSDMA dated 5-08-2024, requesting the NDMA to provide guidance and support- technical assistance for conducting a Post-Disaster Needs Assessment (PDNA) exercise as per paper 2 nd read above. As per paper read as 4 th above, NDMA has intimated their guidance and support - technical assistance for the PDNA and has also shared the Terms of Reference and the NDMA Team Composition for Wayanad Landslide PDNA Exercise. It is also informed that the team from NDMA will arrive at Calicut on 25.08.2024 and the PDNA process will be held from 26.08.2024 to 31.08.2024. In the circumstances, Government are pleased to constitute sector wise Post Disaster Need Assessment team for Wayanad as detailed below. The Terms of Reference

for the PDNA team is also approved.

Principal Secretary, Disaster Management & State Relief Commissioner will oversee the PDNA process, Member Secretary- KSDMA will supervise the State level Officers and District Collector- Wayanad will be in charge of District Officers.

Sector Wise Team Composition for Wayanad Landslide PDNA

Sector/ Accountability	***Name/s***
Team Leads and Overall **Report Preparation**	Dr. Sekhar Lukose Kuriakose and Prof. R Pradeep Kumar
Hazard Analysis	Dr. Debi Prasanna Kanungo, Dipali Jindal, Sathyakumar C J, Dr. Monish Jose, Dr.Hari Kumar, Mr. G. Sankar, Ms. Anaswara Devi B. R
Social Sectors	
Housing and Settlements	Amit Tandon, Ajay Chourasia Dr. Manoj Kumar Kini, Ar. Arya Narendran
Education	Amit Tandon Saseendra Vyas
Health and Nutrition	Cyriac K J, Dr. Anish T.S, Dr. Jazeela A
Public building and Civic Amenities (Urban and Rural)- including	Ajay Chourasia, Amit Tandon Dr. Hari Kumar, Mr.
Commercial Infrastructure	Sreerag R.E, Ms. Anna John
Psycho-Social well being	Cyriac K J, Dr Aparna Nair, Mr. Joe John George, Ms. Ziya Arun
Infrastructure	
Drinking Water and Sanitation	Amit Tandon, Mr. P.C Majeed, Ms. Shenu Jose
Roads and Bridges	Indraneel Bose, Dipali Jindal, Sathyakumar C J, Mr. Baiju P.B, Ms.

	Keerthana Ramesh
Power	M A Dasarathi, Dipali Jindal, Sathyakumar C J, Mr. Prasanth
Irrigation (Minor Canals/ Traditional Irrigation System)	Amit Tandon, Ajay Chourasia, Mr. P.C Majeed, Ms. Shenu Jose
Productive	
Agriculture and Horticulture(including plantations and agriculture labour)	Abhinav Walia, Suvas Chandra Mohanty Dr. Yamini Varma, Dr. Arunjith P
Animal Husbandry and Livestock	Abhinav Walia, Suvas Chandra Mohanty Dr. Rajesh, Mrs. Femy Mathew
Tourism	Abhinav Walia, Suvas Chandra Mohanty, Mr. Prabhath
MSME, Small/ local Businesses, Livelihoods	Suvas Chandra Mohanthy, Abhinav Walia, Smt. Liziamma Samuel
Cross Cutting	
Disaster Risk Reduction	Amit Tandon, Dr. Debi Prasanna Kanungo, Dipali Jindal, Sathyakumar C J, Cyriac K J, Dr. Sekhar Lukose Kuriakose
Forest and Environment	Abhinav Walia, Suvas Chandra Mohanty, Mr. Ajith K Raman, Dr. Pratheesh Maman, Mr. Dinesh K.S, Ms. Amrutha K
Social Inclusion- Tribals, Elderly, Persons with Disability, Gender Perspectives	Cyriac K J, Amit Tandon, Sathyakumar C J, Dipali Jindal, Dr. Annie George, Ms. Anagha, Mr. Joe John George

Terms of Reference

Wayanad Landslide-Post Disaster Needs Assessment (PDNA)

The objective of the PDNA is to assess the damages caused by the Landslide in Wayanad, Kerala and define a strategy for recovery and reconstruction, including estimation of financial costs across the impacted sectors.

The specific objectives of the PDNA are as follows:

- Estimate the overall impact of the disaster event on the lives, livelihoods and property of the affected communities; and assess the loss and damage under the social, productive, health, infrastructure, tourism and livelihoods, forest and environment, and DRR sectors, integrating gender and tribal inclusion.
- Assess the impacts of the disaster to develop a Recovery and Reconstruction Strategy to address the early, medium- and long-term recovery and reconstruction needs with costs and a timeline in one consolidated report.
- Ensure that strategies for recovery and reconstruction integrate concepts of disaster risk reduction and “build back better” and address gender and environmental concerns;
- Developing a recovery and reconstruction strategy that is representative of the needs and priorities of the affected communities considering the ecological and geographical challenges
- Recommend and define a strategy for Disaster Risk Management
- Recommend institutional mechanisms and policy options to be undertaken in support of the recovery and reconstruction process and that promote long term disaster resilience
- Recommend an overall “build back better” cost considering the sectoral need assessment.

Process for conducting the Post-Disaster Needs Assessment

This PDNA exercise will be led by the Government of Kerala and will be jointly supported by NDMA, NIDM, and other agencies. The following process may be followed for PDNA.

1. Setting up the Team, Preparation, and Coordination

- Kerala State Disaster Management Authority will constitute a multi-stakeholder state-level team consisting of sector experts, representatives from the Government, international organizations, institutions, and

other relevant stakeholders.

- Establish a coordination mechanism with clear roles, responsibilities, and deadlines for each team member and define the scope and objectives of PDNA.
- At the District level, the district team will be led by the District Collector and will consist of members from DDMA, heads of the line departments, supported by Executive Engineers and Asst. Executive Engineers from the departments (PWD, LSGD Engineering, Minor Irrigation, Water Authority), Rural Development, Kudumbashree, SC/ST Development Department, Mining and Geology, Forest Department, Tourism Department, Women and Child Department, Social Justice Department and other relevant departments as desired by District Collector.

2. Training Program

- Experts from NDMA, NIDM, and other agencies will conduct a training program for constituted teams focusing on the process, data collection, analysis, recovery needs, and report writing for PDNA.
- NDMA will provide templates for data collection, damage assessment, and identifying recovery needs to KSDMA.

3. Sectoral Assessments

- Sectoral assessments will be done by sectoral teams constituted by the State.

Assessments will include detailed assessments for each affected sector.

- State Government team and district officials will support the sector teams in the provision of baseline information, damage data, GPS locations, photographs, losses, impact, and identifying recovery needs.

4. Drafting of the PDNA report:

Following the collection of data, the team will prepare the report. The report will present sector-wise damage. The cost estimates of all the damage will be included in the report. The basis for estimating the cost of damage, including the unit cost, must be included in the sector report.

- KSDMA will be responsible for drafting the report by compiling the assessment findings, analyses, and proposed strategies into a comprehensive document.
- NDMA will provide technical inputs and comments on each sector, data collected, unit cost estimates, recovery needs, etc.
- NDMA will provide guidance in preparing the final reports.
- KSDMA will incorporate comments by the Sector experts, NDMA and prepare the final report.

5. Submission of Final report

- KSDMA shall submit the final reports to MHA for approval.

Assessment District: Wayanad, Kerala
Sectors for Post Disaster Needs Assessments
The damage and loss assessments and estimation of recovery and reconstruction needs will be undertaken under the following sectors
Social Sectors

a. Housing and Settlements
b. Education
c. Health and Nutrition
d. Public building and Civic Amenities
e. Psycho-Social wellbeing Infrastructure

Infrastructure

a. Drinking Water and Sanitation
b. Roads - Major District Roads/Other District Roads/ Village Roads/ Bridges
c. Power
d. Irrigation (Minor Canals/ Traditional Irrigation System)

Productive

a. Agriculture and Horticulture (including plantations and agriculture

labour)

b. Animal Husbandry and Livestock
c. Tourism
d. MSME, Small/ local Businesses, Livelihoods

Cross-Cutting

a. Disaster Risk Reduction and Environment
b. Forest and Environment
c. Social Inclusion- Tribals, Elderly, Persons with Disability, Gender Perspectives

PDNA Team constituted by the Government of Kerala for the Wayanad Landslide is as follows: Team members nominated by NDMA to be at Wayanad from 25-8-2024 to 01-09-2024

1. Prof. R Pradeep Kumar, Director, CBRI
2. Dr Debi Prasanna Kanungo, Chief Scientist & Professor (AcSIR), CBRI
3. Dr Ajay Chourasia, Chief Scientist, CBRI
4. Cyriac K J, Social Safeguards Specialist, NIUA, MoHUA, GOI
5. Amit Tandon, Consultant- CDRI
6. M A Dasarathi, Power Expert- CDRI
7. Indranil Bose- Roads Expert- CDRI
8. Dipali Jindal, Senior Consultant (Landslides and Avalanches), NDMA
9. Sathyakumar C J, Senior Consultant (HRVA), NDMA
10. Abhinav Walia, Senior Consultant, Disaster Management
11. Suvas Chandra Mohanty, Lead Consultant- Capacity, Building and Training

Team members nominated by KSDMA to be at Wayanad from 25-8-2024 to 01-09-2024

1. Dr. Monish Jose, Assistant Professor, KILA

2. Mr. Joe John George, Consultant DRR, KSDMA.
3. Dr. Annie George, Executive Director, Bedroc
4. Dr. Arunjith P, Specialist (Soil Science), Landuse Board
5. Dr. Anish T.S, Associate Professor, Public Health, Govt. Medical College, Manjeri
6. Dr. Manoj Kumar Kini, Managing Director, KTIL
7. Mr. Baiju P.B, Executive Engineer, KRFB
8. Mr. Sreerag R.E, AEE, Kalpetta Block, LSGD Engineering Department
9. Mr. Dinesh K.S, Environmental Engineer, PCB, Kazargode
10. Ms. Anaswara Devi B.R, Hazard Analyst (Geology), KSDMA
11. Ms. Anna John, Urban Planner, KSDMA
12. Ar. Arya Narendran, Architect, KSDMA
13. Ms. Shenu Jose, Hydrologist, KSDMA
14. Ms. Anagha, Rural Development Specialist, KSDMA
15. Dr. Pratheesh Maman, Project Coordinator, KSDMA
16. Dr. Hari Kumar, Geohazards Society
17. Mr. G. Sankar, Scientist G (Rtd), NCESS and Member, Landslide Advisory Committee, KSDMA
18. Dr. Sekhar Lukose Kuriakose, Member Secretary, KSDMA (ex-officio) & Head, Kerala State Emergency Operations Centre

Team members from Wayanad to be available for the PDNA process from 25-8-2024 to 01-9- 2024

1. Mr. Prabhath, Deputy Director, Tourism, Wayanad
2. Dr. Rajesh, DAHO, Animal Husbandry Department, Wayanad
3. Mrs. Femy Mathew, Deputy Director, Dairy Development Department, Wayanad
4. Mr. P.C Majeed, Joint Director (LSGD), MGNREGS, Wayanad
5. Mr. Ajith K Raman, DFO, Wayand (South)
6. Dr. Yamini Varma, Dean, College of Agriculture, Ambalavayal, Wayanad

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7. Mr. Prasanth, Deputy Chief Engineer (Distribution), KSEB, Kalpatta
8. Smt. Liziamma Samuel, District Industries Centre Wayanad.
9. Sri. Saseendra Vyas, DDE Wayand
10. Dr. Aparna Nair, District Nodal Officer, Mental Health Programme, Wayanad

The following team members will support their respective counterparts from KSDMA HQ, Trivandrum

1. Ms. Ziya Arun, Hazard Analyst (Psychology)
2. Ms. Amrutha K, Hazard Analyst (Environment)
3. Dr. Jazeela A, Hazard Analyst (Public Health)

Ms. Keerthana Ramesh, Hazard Analyst (Civil)

All expenses in connection with the Post Disaster Needs Assessment (PDNA) will be met from the plan fund of KSDMA.

(By order of the Governor)
TINKU BISWAL
PRINCIPAL SECRETARY

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The Commissioner, Disaster Management
The District Collector,Wayanad
The Member Secretary, Kerala State Disaster Management Authority,
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Agriculture Department
Animal Husbandry Department
Dairy Development Department
Forest Department
Power Department
Health Department
Environment Department

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POST DISASTER NEEDS ASSESSMENT

MEPPADI
LANDSLIDE

2024

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