

# Disaster Risk Reduction (Tsunami Hazard)

Updated 10 October 2023

## Overall Strategies

### a. Human Resource

- Training human resource in the analysis of multi-natural hazard mapping and modeling for seismic and hydro-geologic hazards.
- Increase and availability of experts.
- Capacity Building and Training for stakeholders and beneficiaries.
- Partnership with LGUs for community-based warnings
- Trained human resource on integrating tsunami hazard information in DRR plans at the local levels

### b. R&D Technologies

- Maintenance and updating of data platforms.
- Establishment of accurate and precise early warning systems for multi-natural hazards.
- Updating Vulnerability and Risk Maps.
- Operationalization of outputs from the stakeholders by the mandated agencies.

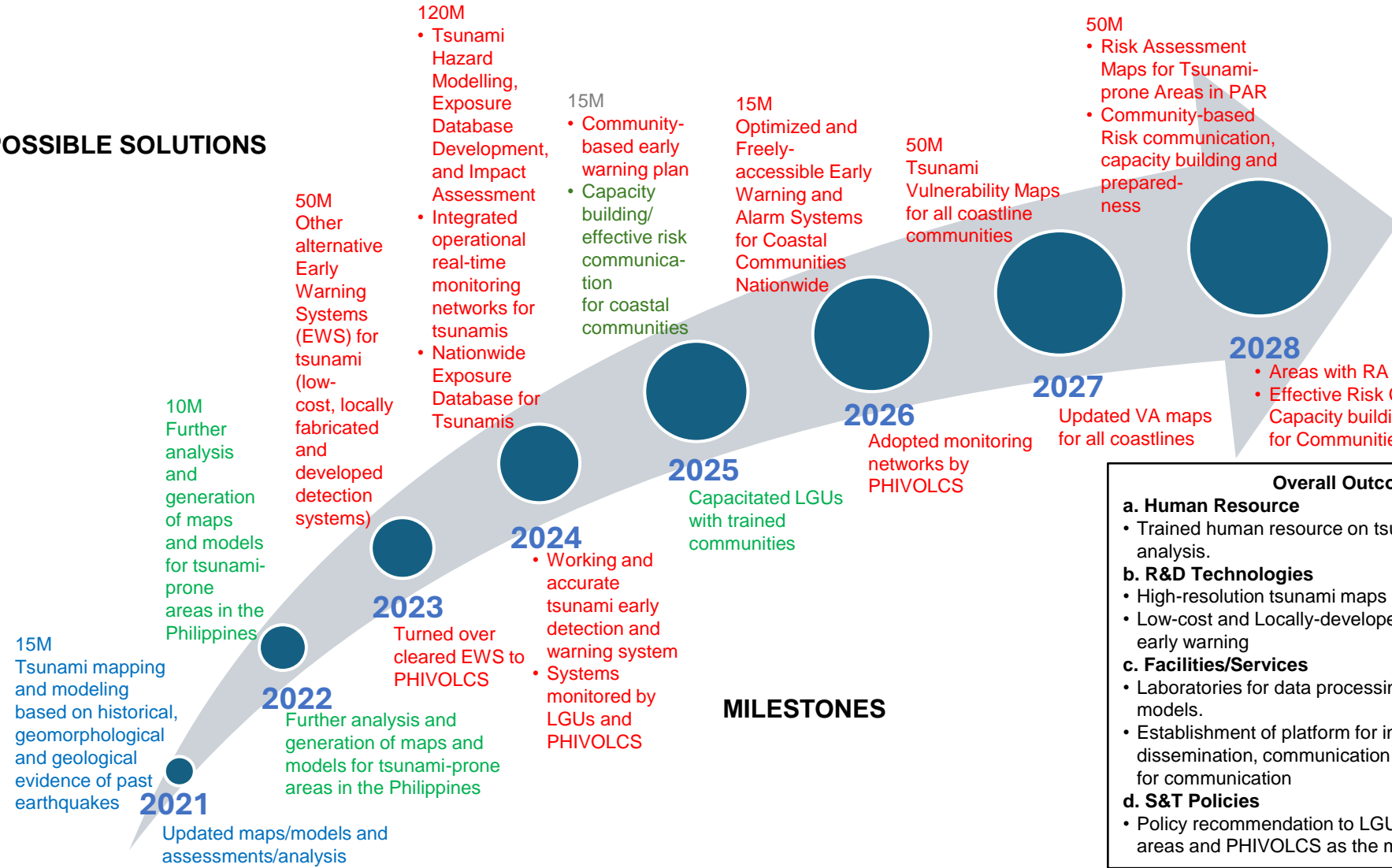
### c. Facilities and Services

- Establishment of GIS and remote sensing processing laboratories for big data analytics.

### d. S&T Policies

- Dialogue and coordination with LGUs and policy-makers for concrete applications.

## POSSIBLE SOLUTIONS



## VISION

Readily accessible maps and models for the most vulnerable and high-risk areas capable of early detection and warning for tsunamis

## Overall Outcomes

- a. Human Resource**
  - Trained human resource on tsunami processing and analysis.
- b. R&D Technologies**
  - High-resolution tsunami maps and models
  - Low-cost and Locally-developed instrumentation for early warning
- c. Facilities/Services**
  - Laboratories for data processing tsunami maps and models.
  - Establishment of platform for information and dissemination, communication plan and other tools for communication
- d. S&T Policies**
  - Policy recommendation to LGUs in tsunami-prone areas and PHIVOLCS as the mandated agency.

## MILESTONES

# List of Projects (for the whole duration of the roadmap)

R&D Technologies	Project Title	Budget Allocation ('000)							Status
		2022	2023	2024	2025	2026	2027	2028	
Updated nationwide Earthquake Hazard Maps	Investigation and numerical modelling of Philippine tsunamis based on historical, geomorphological and geological evidence of past earthquakes	-	-	-	-	-	-	-	Completed
Further analysis and generation of maps and models for tsunami-prone areas in the Philippines and Capacitated LGUs with trained communities	Deterministic Liquefaction and Tsunami Hazard Mapping of Selected Low-lying Areas in the Philippines using GIS, AI, and Geophysical Techniques		13,427	11,949					Ongoing



# Disaster Risk Reduction (Earthquake Hazard)

Updated 10 October 2023

## Overall Strategies

### a. Human Resource

- Training human resource in the analysis of multi-natural hazard mapping and modeling for seismic and hydro-geologic hazards.
- Increase and availability of experts.
- Capacity Building and Training for stakeholders and beneficiaries.
- Partnership with LGUs for community-based warnings
- Trained human resource on integrating tsunami hazard information in DRR plans at the local levels

### b. R&D Technologies

- Maintenance and updating of data platforms.
- Establishment of accurate and precise early warning systems for multi-natural hazards.
- Updating Vulnerability and Risk Maps.
- Operationalization of outputs from the stakeholders by the mandated agencies.

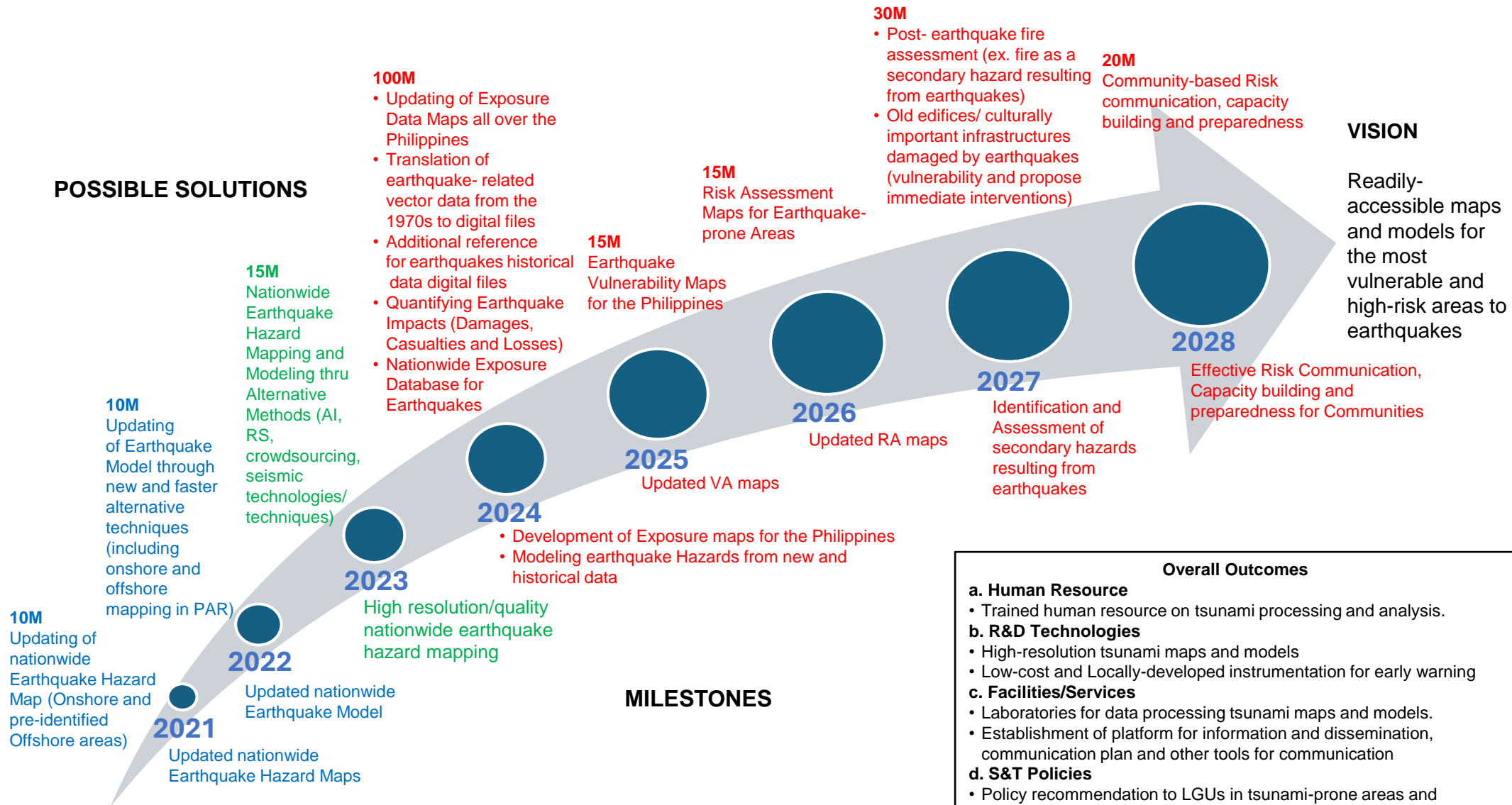
### c. Facilities and Services

- Establishment of GIS and remote sensing processing laboratories for big data analytics.

### d. S&T Policies

- Dialogue and coordination with LGUs and policy-makers for concrete applications.

## POSSIBLE SOLUTIONS



## VISION

Readily-accessible maps and models for the most vulnerable and high-risk areas to earthquakes

## MILESTONES

**Overall Outcomes**

**a. Human Resource**

- Trained human resource on tsunami processing and analysis.

**b. R&D Technologies**

- High-resolution tsunami maps and models
- Low-cost and Locally-developed instrumentation for early warning

**c. Facilities/Services**

- Laboratories for data processing tsunami maps and models.
- Establishment of platform for information and dissemination, communication plan and other tools for communication

**d. S&T Policies**

- Policy recommendation to LGUs in tsunami-prone areas and PHIVOLCS as the mandated agency.

# List of Projects (for the whole duration of the roadmap)

R&D Technologies	Project Title	Budget Allocation ('000)							Status
		2022	2023	2024	2025	2026	2027	2028	
Updated nationwide Earthquake Hazard Maps and Models	Geospatial Information Management & Analysis Project for Hazards & Risk Assessment in the Philippines (GeoriskPH)	-	-		-	-	-	-	Completed
	Integrative Studies on the Geodynamics of the Philippine and Taiwan Arc Systems								
Nationwide Earthquake Hazard Mapping and Modeling thru Alternative Methods (AI,RS crowdsourcing,seismic technologies/techniques)	Accelerated Earthquake Multi-hazards Mapping And Risk Assessment Program of the Philippines	-	60,958	45,641	-	-	-	-	Ongoing
	Growth of an island arc (GAIA): Tectonic consequences and human impacts	3,562	3,562						
	Marine and onshore geophysical investigations of the Manila subduction zone	2,972	2,972						
	Paleoseismology and Hazard Assessment of Seismogenic Sources in Northern Luzon, Philippines			5,563	4,434				



# List of Projects (for the whole duration of the roadmap)

R&D Technologies	Project Title	Budget Allocation ('000)							Status
		2022	2023	2024	2025	2026	2027	2028	
Updated nationwide Volcanic Eruption data	Marine and onshore geophysical investigations of the Manila subduction zone	2,972	2,972		-	-	-	-	Completed
	Growth of an island arc (GAIA): Tectonic consequences and human impacts	6,546	6,546						
Alternative locally- fabricated instruments for measuring data and seismic activity	From Source Terranes to Basin Evolution (STroBE): Geochronology, Sediment Provenance, and Depositional History of the northern Cagayan Valley Basin			6,542	3,453	-	-	-	New
	Volcano-hydrothermal system models of Philippine volcanoes: tracking the fluids and related hazards in Cagua and Hibok-hibok Volcanoes, Philippines			5,401	2,448	2,150			New



# Disaster Risk Reduction (Volcanic Eruption Hazard)

Updated 10 October 2023

## Overall Strategies

### a. Human Resource

- Training human resource in the analysis of multi-natural hazard mapping and modeling for seismic and hydro-geologic hazards.
- Increase and availability of experts.
- Capacity Building and Training for stakeholders and beneficiaries.
- Partnership with LGUs for community-based warnings
- Trained human resource on integrating tsunami hazard information in DRR plans at the local levels

### b. R&D Technologies

- Maintenance and updating of data platforms.
- Establishment of accurate and precise early warning systems for multi-natural hazards.
- Updating Vulnerability and Risk Maps.
- Operationalization of outputs from the stakeholders by the mandated agencies.

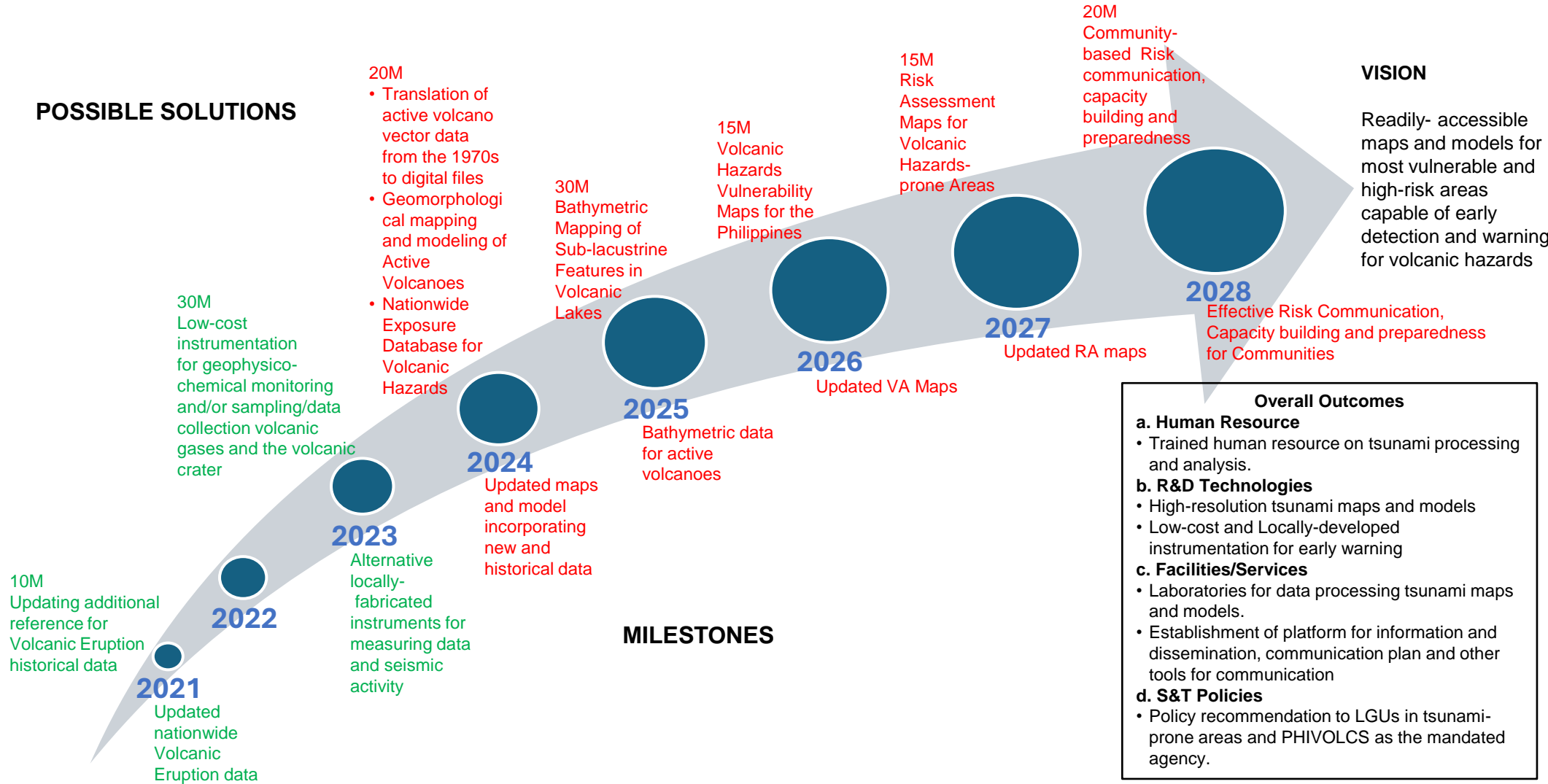
### c. Facilities and Services

- Establishment of GIS and remote sensing processing laboratories for big data analytics.

### d. S&T Policies

- Dialogue and coordination with LGUs and policy-makers for concrete applications.

## POSSIBLE SOLUTIONS



# Disaster Risk Reduction (Landslide Hazard)

Updated 10 October 2023

## Overall Strategies

### a. Human Resource

- Training human resource in the analysis of multi-natural hazard mapping and modeling for seismic and hydro-geologic hazards.
- Increase and availability of experts.
- Capacity Building and Training for stakeholders and beneficiaries.
- Partnership with LGUs for community-based warnings
- Trained human resource on integrating tsunami hazard information in DRR plans at the local levels

### b. R&D Technologies

- Maintenance and updating of data platforms.
- Establishment of accurate and precise early warning systems for multi-natural hazards.
- Updating Vulnerability and Risk Maps.
- Operationalization of outputs from the stakeholders by the mandated agencies.

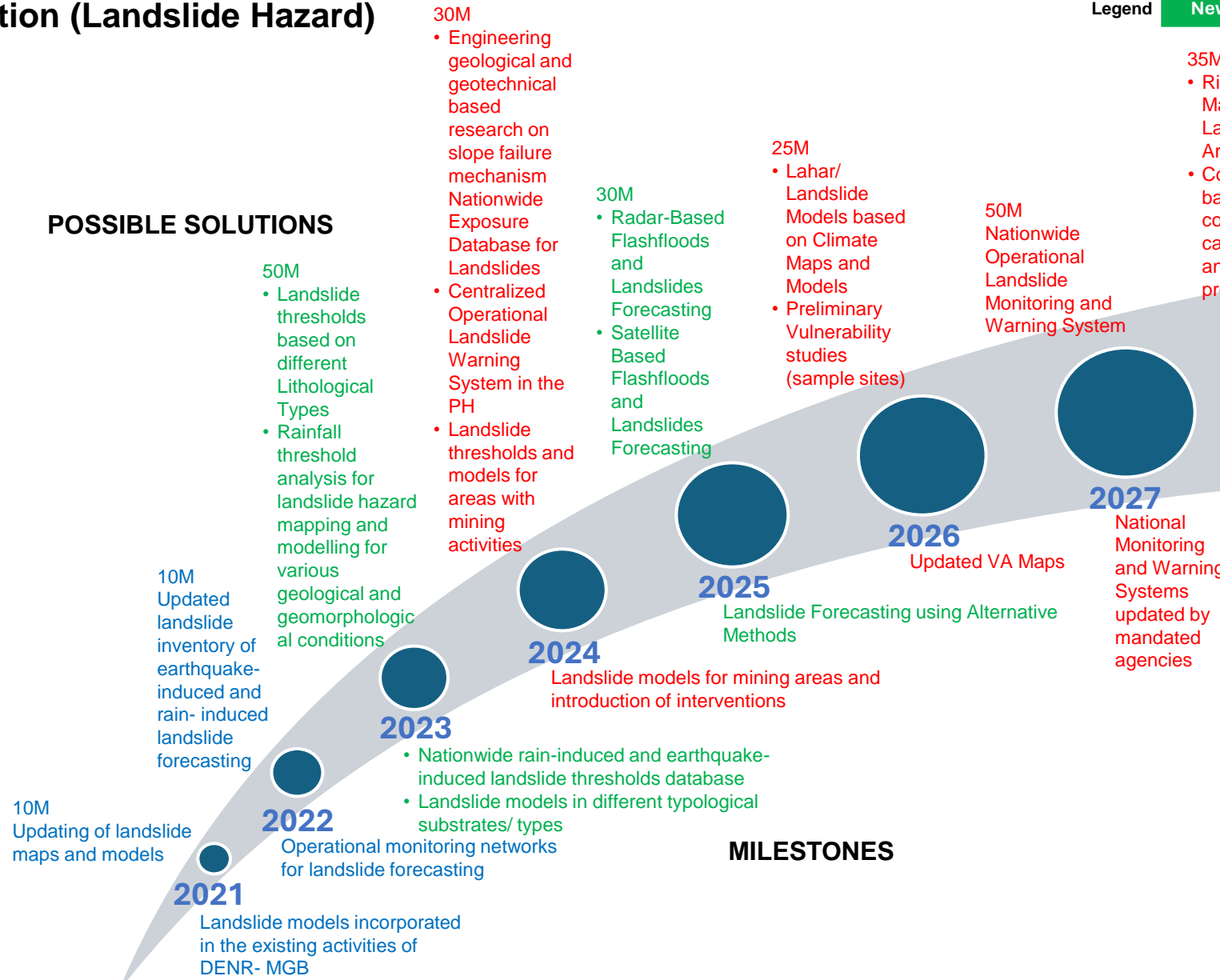
### c. Facilities and Services

- Establishment of GIS and remote sensing processing laboratories for big data analytics.

### d. S&T Policies

- Dialogue and coordination with LGUs and policy-makers for concrete applications.

## POSSIBLE SOLUTIONS



## VISION

Readily- accessible maps and models for most vulnerable and high-risk areas capable of early detection and warning for landslides

### Overall Outcomes

- a. Human Resource**
- Trained human resource on tsunami processing and analysis.
- b. R&D Technologies**
- High-resolution tsunami maps and models
  - Low-cost and Locally-developed instrumentation for early warning
- c. Facilities/Services**
- Laboratories for data processing tsunami maps and models.
  - Establishment of platform for information and dissemination, communication plan and other tools for communication
- d. S&T Policies**
- Policy recommendation to LGUs in tsunami-prone areas and PHIVOLCS as the mandated agency.



# List of Projects (for the whole duration of the roadmap)

R&D Technologies	Project Title	Budget Allocation ('000)							Status
		2022	2023	2024	2025	2026	2027	2028	
Operational monitoring networks for landslide forecasting and Landslide models incorporated in the existing activities of DENR- MGB	Simulating Catastrophic Rainfall-triggered landslides and related sedimentation in the Philippines (SCaRP)	4,910	5,071						Completed
Nationwide rain-induced and earthquake-induced landslide thresholds database and Landslide models in different typological substrates/ types	Landslide Investigations for Geohazards Preparedness and Timely Advisories in the Philippines (LIGTAS)	4,981							Ongoing
Landslide Forecasting using Alternative Methods	Deterministic Ground Shaking and Earthquake-Induced Landslide Hazard Modeling Using Geophysics, Remote Sensing, and Artificial Intelligence		17,078	16,646					Ongoing
	Landslide Investigations for Geohazards preparedness and Timely Advisories in the Philippines: Advanced Geospatial Approaches for DRRM(LIGTAS-AGAD)			16,827	11,674	11,497			New





# Disaster Risk Reduction (Tropical Cyclone Hazard)

Updated 5 December 2023

Legend	New/ Ongoing	Completed	Target
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## Overall Strategies

### a. Human Resource

- Training human resource in the analysis of multi-natural hazard mapping and modeling for seismic and hydro-geologic hazards.
- Increase and availability of experts.
- Capacity Building and Training for stakeholders and beneficiaries.
- Partnership with LGUs for community-based warnings
- Trained human resource on integrating tsunami hazard information in DRR plans at the local levels

### b. R&D Technologies

- Maintenance and updating of data platforms.
- Establishment of accurate and precise early warning systems for multi-natural hazards.
- Updating Vulnerability and Risk Maps.
- Operationalization of outputs from the stakeholders by the mandated agencies.

### c. Facilities and Services

- Establishment of GIS and remote sensing processing laboratories for big data analytics.

### d. S&T Policies

- Dialogue and coordination with LGUs and policy-makers for concrete applications.

## POSSIBLE SOLUTIONS

20M

- Improvement of the Prediction and Forecasting for extreme events
- SOPs for Impact-Based Forecasting and Risk Assessment
- Cloud/ Thunderstorm High-resolution Near real-time
- Detection/ Mapping/Monitoring for Micro-weather Forecasting

30M

- Updating of typhoon maps and models

60M

- Application of predictive analytics on magnitude TC rapid intensification
- Nationwide Intensity Forecast Guidance of Tropical Thunderstorms and Tropical Cyclones
- Ocean Forecast System for Marine Activities and related Disasters e.g. Ship Route Gale warning Visualization
- Bow Echo Detection for Tornado Warning

150M

- Application of Artificial (AI) Intelligence in Weather Forecasting for Tropical Cyclones
- Storm surge forecasting using wind and wave current for the country
- Automation of storm surge models

150M

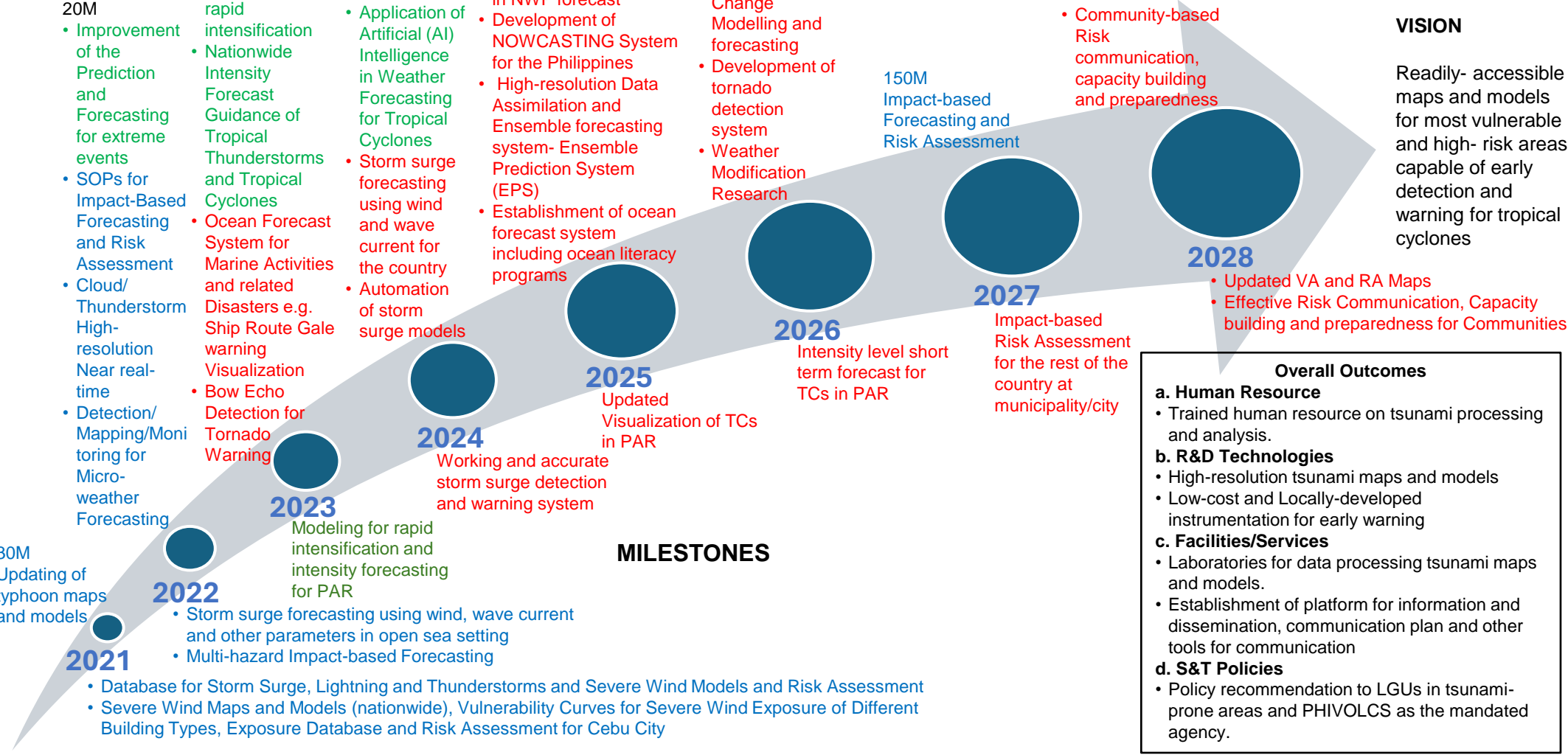
- Development of Multi-Model Prediction System
- Application of Model Output Statistics (MOS) in NWP forecast
- Development of NOWCASTING System for the Philippines
- High-resolution Data Assimilation and Ensemble forecasting system- Ensemble Prediction System (EPS)
- Establishment of ocean forecast system including ocean literacy programs

150M

- Typhoon Structure/Wind Radii/Intensity Change Modelling and forecasting
- Development of tornado detection system
- Weather Modification Research

50M

- Vulnerability and Risk Assessment Maps for Tropical Cyclone-prone Areas
- Community-based Risk communication, capacity building and preparedness



## VISION

Readily- accessible maps and models for most vulnerable and high- risk areas capable of early detection and warning for tropical cyclones

2028

- Updated VA and RA Maps
- Effective Risk Communication, Capacity building and preparedness for Communities

2027

- Impact-based Risk Assessment for the rest of the country at municipality/city

2026

- Intensity level short term forecast for TCs in PAR

2025

- Updated Visualization of TCs in PAR

2024

- Working and accurate storm surge detection and warning system

2023

- Modeling for rapid intensification and intensity forecasting for PAR

2022

- Storm surge forecasting using wind, wave current and other parameters in open sea setting
- Multi-hazard Impact-based Forecasting

2021

- Database for Storm Surge, Lightning and Thunderstorms and Severe Wind Models and Risk Assessment
- Severe Wind Maps and Models (nationwide), Vulnerability Curves for Severe Wind Exposure of Different Building Types, Exposure Database and Risk Assessment for Cebu City

## MILESTONES

**Overall Outcomes**

**a. Human Resource**

- Trained human resource on tsunami processing and analysis.

**b. R&D Technologies**

- High-resolution tsunami maps and models
- Low-cost and Locally-developed instrumentation for early warning

**c. Facilities/Services**

- Laboratories for data processing tsunami maps and models.
- Establishment of platform for information and dissemination, communication plan and other tools for communication

**d. S&T Policies**

- Policy recommendation to LGUs in tsunami-prone areas and PHIVOLCS as the mandated agency.

# List of Projects (for the whole duration of the roadmap)

R&D Technologies	Project Title	Budget Allocation ('000)							Status
		2022	2023	2024	2025	2026	2027	2028	
Cloud/Thunderstorm High-resolution Near real-time Detection/Mapping/Monitoring for Micro-weather Forecasting	A Dispersive Long-Wave Model for Predicting Coastal Flooding due to Storm Surges and Surface Waves in Manila Bay								Completed
	Understanding Lightning and Thunderstorms for Extreme Weather Monitoring and Information Sharing (ULAT)	15,625							Completed
Severe Wind Maps and Models, Vulnerability Curves for Severe Wind Exposure of Different Building Types, Exposure Database and Risk Assessment for Cebu City	Severe Wind Hazard and Risk Assessment for Cebu City								Completed
Multi-hazard Impact-based Forecasting	Weather and Climate Science for Service Partnership for South-East Asia: Building a Safer Community to Weather and Climate Variability through Science and Innovation	6,034							Completed
Improvement of the Prediction and Forecasting for extreme events	Scaling Up Climate Information Services for Societal Benefits (CLIM' UP)								Ongoing
Application of predictive analytics on magnitude TC rapid intensification	Analysis of Tropical Cyclone Rapid Intensification in the Philippines: Its Characteristics, Impacts and Future Projections		3,233	1,765					Ongoing
Nationwide Intensity Forecast Guidance of Tropical Thunderstorms and Tropical Cyclones	Advancing scientific and technical capabilities in support to economic development through the improvement of forecast capability on weather, marine meteorology and short-range climate (IFC-WMMSRC)	11,210	11,206						Ongoing
Ocean Forecast System for Marine Activities and related Disasters e.g. Ship Route Gale warning Visualization	Establishment of Seamless Prediction Capability on Typhoon, Marine Meteorology and Short-Range Climate (MECO-TECO VOTE Phase III)			14,922	12,686	12,381			New



# Disaster Risk Reduction (Floods and Heavy Rains Hazard)

Updated 5 December 2023

Legend	New/ Ongoing	Completed	Target
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## Overall Strategies

### a. Human Resource

- Training human resource in the analysis of multi-natural hazard mapping and modeling for seismic and hydro-geologic hazards.
- Increase and availability of experts.
- Capacity Building and Training for stakeholders and beneficiaries.
- Partnership with LGUs for community-based warnings
- Trained human resource on integrating tsunami hazard information in DRR plans at the local levels

### b. R&D Technologies

- Maintenance and updating of data platforms.
- Establishment of accurate and precise early warning systems for multi-natural hazards.
- Updating Vulnerability and Risk Maps.
- Operationalization of outputs from the stakeholders by the mandated agencies.

### c. Facilities and Services

- Establishment of GIS and remote sensing processing laboratories for big data analytics.

### d. S&T Policies

- Dialogue and coordination with LGUs and policy-makers for concrete applications.

## POSSIBLE SOLUTIONS

40M

- Intelligent storm drain/canal sensors and/or systems

- Street level/ barangay level/ community level near-real time river monitoring and early warning system for all rivers nationwide
- Municipality / City Level Early Warning Forecasting for Floods

20M  
Updating of flood maps and models

- Flood monitoring systems (river inputs and heavy rains) and community-based EWS

30M

- Community or Barangay Level Near-real time Flood Forecasting for Vulnerable Areas
- Land subsidence
- Urban/river flooding

130M

- Flood Forecasting & Early Warning using Advance Technology (Radar, Satellite, High Resolution Modelling and others)
- Convective Scale Modelling and Ensembled Forecasting
- Nationwide Exposure Database for Landslides

25M

- Advanced Space Technology for Real-Time Flood Monitoring; Internet of Things (IoT) Approach and Cloud Computing in Flood Forecasting
- Sedimentological and geomorphological approach in flood hazard models: Identifying recurrence pattern using direct evidence

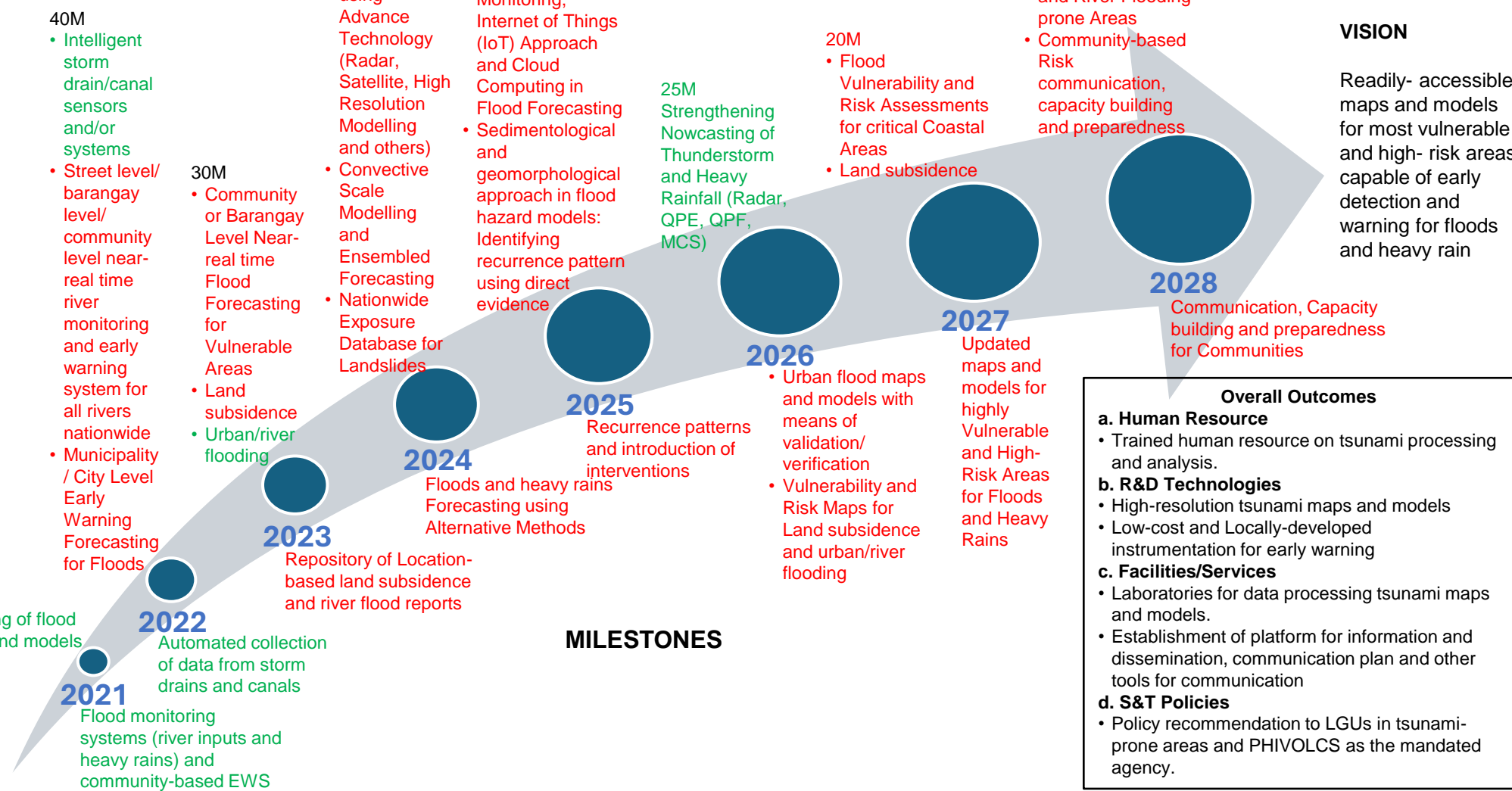
25M  
Strengthening Nowcasting of Thunderstorm and Heavy Rainfall (Radar, QPE, QPF, MCS)

20M

- Flood Vulnerability and Risk Assessments for critical Coastal Areas
- Land subsidence

50M

- Nationwide Vulnerability and Risk Assessment Studies for Urban and River Flooding-prone Areas
- Community-based Risk communication, capacity building and preparedness



## VISION

Readily- accessible maps and models for most vulnerable and high- risk areas capable of early detection and warning for floods and heavy rain

2028

Communication, Capacity building and preparedness for Communities

2027

Updated maps and models for highly Vulnerable and High-Risk Areas for Floods and Heavy Rains

2026

- Urban flood maps and models with means of validation/ verification
- Vulnerability and Risk Maps for Land subsidence and urban/river flooding

2025

Recurrence patterns and introduction of interventions

2024

Floods and heavy rains Forecasting using Alternative Methods

2023

Repository of Location-based land subsidence and river flood reports

2022

Automated collection of data from storm drains and canals

2021

Flood monitoring systems (river inputs and heavy rains) and community-based EWS

## MILESTONES

### Overall Outcomes

- a. Human Resource**
  - Trained human resource on tsunami processing and analysis.
- b. R&D Technologies**
  - High-resolution tsunami maps and models
  - Low-cost and Locally-developed instrumentation for early warning
- c. Facilities/Services**
  - Laboratories for data processing tsunami maps and models.
  - Establishment of platform for information and dissemination, communication plan and other tools for communication
- d. S&T Policies**
  - Policy recommendation to LGUs in tsunami-prone areas and PHIVOLCS as the mandated agency.



# List of Projects (for the whole duration of the roadmap)

R&D Technologies	Project Title	Budget Allocation ('000)							Status
		2022	2023	2024	2025	2026	2027	2028	
Urban/river flooding Intelligent storm drain/canal sensors and/or systems	Smart Cities Solution to Urban Flooding (SMART Turf) Program	14,411							Ongoing
Strengthening Nowcasting of Thunderstorm and Heavy Rainfall (Radar, QPE, QPF, MCS)	Establishment of Seamless Prediction Capability on Typhoon, Marine Meteorology and Short-Range Climate			14,990	12,559	12,240			New



# Climate Change Adaptation (Climate Change-Related Hazards)

Updated 5 December 2023

## Overall Strategies

### a. Human Resource

- Training human resource in the analysis of multi-natural hazard mapping and modeling for seismic and hydro-geologic hazards.
- Increase and availability of experts.
- Capacity Building and Training for stakeholders and beneficiaries.
- Partnership with LGUs for community-based warnings
- Trained human resource on integrating tsunami hazard information in DRR plans at the local levels

### b. R&D Technologies

- Maintenance and updating of data platforms.
- Establishment of accurate and precise early warning systems for multi-natural hazards.
- Updating Vulnerability and Risk Maps.
- Operationalization of outputs from the stakeholders by the mandated agencies.

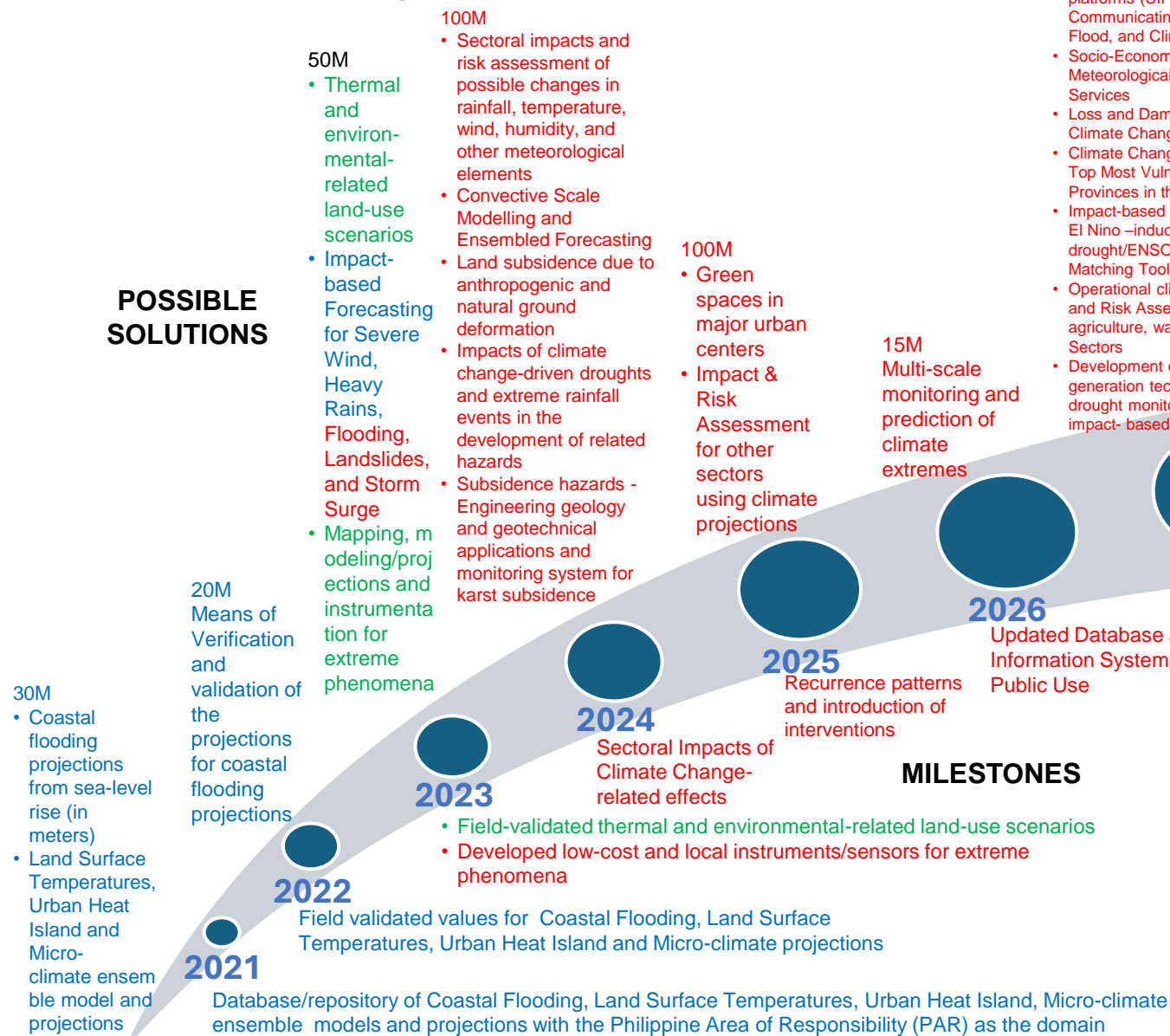
### c. Facilities and Services

- Establishment of GIS and remote sensing processing laboratories for big data analytics.

### d. S&T Policies

- Dialogue and coordination with LGUs and policy-makers for concrete applications.

## POSSIBLE SOLUTIONS



## VISION

Readily- accessible maps and models for most vulnerable and high- risk areas capable of early detection and warning for climate change- related hazards

## Overall Outcomes

- a. Human Resource**
- Trained human resource on tsunami processing and analysis.
- b. R&D Technologies**
- High-resolution tsunami maps and models
  - Low-cost and Locally-developed instrumentation for early warning
- c. Facilities/Services**
- Laboratories for data processing tsunami maps and models.
  - Establishment of platform for information and dissemination, communication plan and other tools for communication
- d. S&T Policies**
- Policy recommendation to LGUs in tsunami-prone areas and PHIVOLCS as the mandated agency.



# List of Projects (for the whole duration of the roadmap)

R&D Technologies	Project Title	Budget Allocation ('000)							Status
		2022	2023	2024	2025	2026	2027	2028	
<p>Thermal and environmental-related land-use scenarios</p> <p>Mapping, modeling/projections and instrumentation for extreme phenomena</p>	<p>Survey of Heatwaves in the Philippine Seas (SHIPS)</p> <p>Providing High Resolution (5km) Climate Change Projections in Philippines using WRF</p>	2,868	2,912						<p>Ongoing</p> <p>Completed</p>
<p>Impact-based Forecasting for Severe Wind, Heavy Rains,</p>	<p>Weather and Climate Science for Service Partnership for South-East Asia: Building a Safer Community to Weather and Climate Variability through Science and Innovation</p>	6,034							Completed

