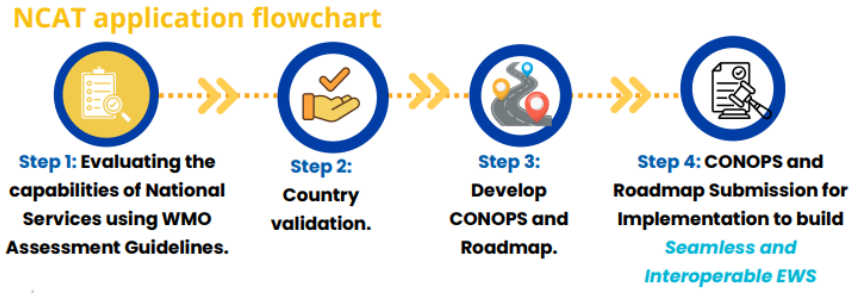
Annex 1 – Template for CREWS Action Presentation Note

Action Title	*Assessing Hydrological and Meteorological Services and Updating Flash Flood Early Warning System in Myanmar*
Country(ies)	*Myanmar*
Partner Country Entity / Entities	*Department of Meteorology and Hydrology (DMH), Myanmar*
Implementing Partner *(if submission by Implementing Partner)*	*World Meteorological Organization (WMO)*
Implementing Partner Requested *(if submission by Partner Country)*	*Select at least 1:* ☐ World Bank/GFDRR ☒ WMO ☐ UNDRR ☐ No preference
Action Type	*Select at least 1:* ☐ Continued Assistance ☒ Analyses and Assessments ☒ Advisory Services ☐ *Support to Project Preparation*
Early Warning System Element(s) Supported	*Select at least 1:* ☒ Monitoring, detection, analysis and forecasting of hydro-meteorological hazards providing lead-times for action. ☐ Dissemination of timely and authoritative warnings ☐ Preparedness and response plans triggered by warnings and weather and climate predictions. ☐ Disaster risk knowledge based on the systematic collection of data and disaster risk assessment.
Contributions to CREWS Programming Principles and	**CREWS Programming Principles addressed:** *Select all relevant:* ☒ People-centred

Results Framework	☒ Gender-responsive ☐ Promotes Coherence ☒ Leverage **CREWS Results Framework Outputs to which the Action is expected to contribute to:** *Select at least one:* ☐ A country and/or region has developed or strengthened legislative and/or institutional frameworks to support and sustain multi-hazard early warning systems. ☒ Multi-hazard needs, gaps and priority assessments, analyses, and related investment plans for early warning systems in a country or region are driven by CREWS financing. ☐ Partnerships and cooperation frameworks developed for financing and scaling up support to multi-hazard early warning systems. ☐ Risk information and tools generated by countries to enable the delivery of impact-based early warnings. ☒ Monitoring, analysis and forecasting of hazards that threaten the country/region are improved and sustained by the countries. ☐ Warnings are communicated by the countries based on common alerting protocols under agreed standard operational procedures (SOPs) ☐ Warnings are received, understood and acted upon based on co-produced preparedness and response plans by the countries. ☐ People of different backgrounds, gender, youth, older persons, people with disability, poor, marginalized, displaced and non-native, as well as related institutions have co-produced climate and weather information products tailored to their needs. ☐ Private sector is engaged to foster innovation and sustainability in delivery of early warning services. **CREWS Programme Indicators to which the Action is expected to contribute to:** *Select at least one:* ☐ Loss of life ☒ Forecasting and warning capacity ☒ Access to early warning ☐ Use of risk information ☒ Capacity to disseminate warnings. ☐ Capacity to prepare for and respond to warnings.

Specific Action and Objectives	*To strengthen the Department of Meteorology and Hydrology's (DMH) flash flood forecasting and warning capabilities by enhancing institutional capacity, upgrading technical infrastructure, thereby improving the overall early warning system (EWS). The assessment will inform the development of a roadmap and costed action plan, which can serve as a basis for the development of a national-level project to strengthen the different pillars of its multi-hazard EWS (MHEWS), aligned with the global vision of the Early Warnings for All (EW4All) initiative.* 1. ***Assessing DMH's capacity to generate and deliver hydrometeorological services through the deployment of the National Capacity Assessment Tool (NCAT)*** *To improve the effectiveness of DMH, a national capacity assessment will be conducted.* *NCAT integrates various WMO guidelines:* • *WMO No. 1286 "Assessment Guidelines for End-to-End Flood Forecasting and Early Warning Systems";* • *the Global Hydrological Status and Outlook System (HydroSOS);* • *the Multi-Hazard Early Warning System (MHEWS) Checklist;* • *EW4All Pillar 2 Rapid Assessment (see also: Early Warnings for All in Focus: Hazard Monitoring and Forecasting); and* • *other relevant WMO Technical Guidelines.* *By incorporating data from the WMO Country Profile Database (CPDB), NCAT evaluates and verifies the existing capacities and capabilities of Hydrological Services within an MHEWS environment. The NCAT will provide the National Meteorological and Hydrological Services (NMHSs) with a tool to evaluate the current state of their EWS(s), identify weaknesses, areas of potential improvements in terms of forecasting and warning of hazards such as floods, landslides, droughts, and others. The NCAT typically results in a Roadmap (Diagnostic of the flood EWS full value chain and Implementation plan to mid-, short- and long-term phases) and Concept of Operations of the EWS for hydrological hazards.*  *Figure 1. NCAT Application process* 2. ***Enhancing Flash Flood Forecasting and Early Warning Capabilities***

Under this output, a new flood forecasting framework will be piloted in a target basin/catchment as an alternative solution to the existing Flash Flood Guidance System (FFGS). The system will utilize freely available global and regional datasets, along with national-scale data from DMH, including Digital Elevation Models (DEMs), soil data, precipitation, and evaporation records. By leveraging satellite-based observations, weather forecasts, and machine-learning techniques, it will predict the spatial and temporal dynamics of flash floods in Myanmar. To enhance accuracy, regional and local data from the Global Telecommunication System (GTS) and WMO Information System (WIS 2.0) can be integrated. The system's outputs will be disseminated through a web-based platform, ensuring accessibility and usability in line with practices adopted by many WMO Members. The Figure 2 below shows the information flow process for the proposed flood forecasting framework that can make use of various datasets and models.

Tachileik, located in the Maesai River Basin and highly prone to frequent flash flooding, was selected as the pilot location. Its vulnerability makes it a suitable site for benchmarking the performance of the system.

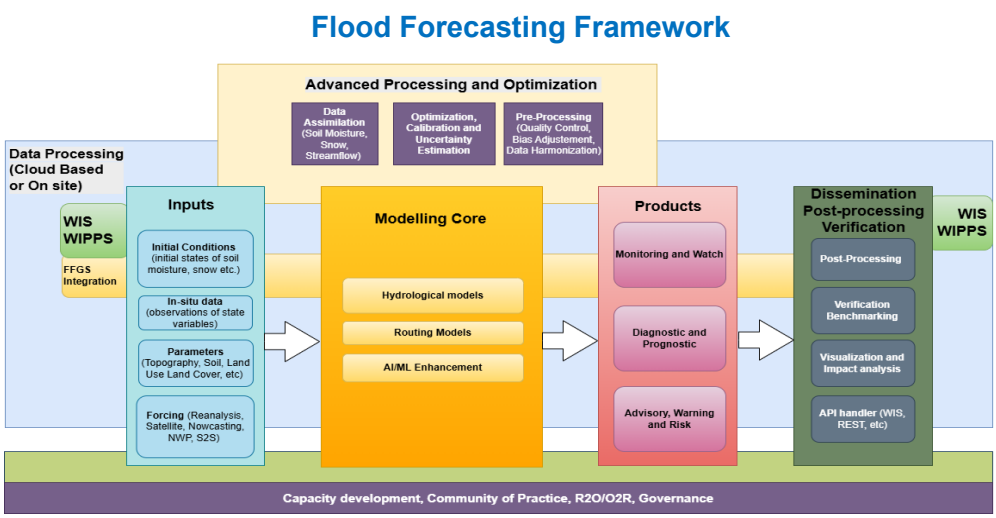


Figure 2. Flood Forecasting Framework Information Flow Diagram

Potential risks and mitigation measures:

Given that Myanmar is a Fragile, Conflict and Vulnerable (FCV) country, there is heightened risk for the conflict to flare up, which may impact the implementation of tasks. However, WMO has worked previously on a project, where the tasks were completed with the engagement of non-governmental organization who worked strongly with DMH and the agricultural community and farmers in the target villages. For this ASW request, WMO will also explore the possibility of working with local experts who are non-state actors and who can facilitate on-ground implementation.

	Further, given the sensitivities around financially supporting the current government and its agencies, WMO will draw upon its network of experts to support with the implementation of the activities.
Need and Rationale	*Myanmar, one of the largest countries in Southeast Asia, is highly vulnerable to various natural hazards, including flooding, landslides, cyclones, and storm surges. In 2015, the torrential rains and the onset of Cyclone Komen triggered severe and widespread floods and landslides in July and August 2015 across 12out of 14 states and regions in Myanmar. An estimated 1.6 million individuals were recorded as having been temporarily displaced from their homes by the disaster, and 132 lost their lives. Up to 5.2 million people were exposed to the floods and landslides in the 40 most heavily affected townships. Within the 40 most-affected townships, 775,810 individuals have been displaced. More recently, in September 2024, flash floods and associated landslides affected nearly 915,586 individuals, including an estimated 270,000 children, leading to 445 fatalities.* *To address these challenges, a standalone FFGS known as the Myanmar FFGS was established with support from the United States Agency for International Development (USAID). However, due to recent developments, there is uncertainty regarding the long-term sustainability of the FFGS. Furthermore, despite the project's reinitiation, it is understood that the current U.S. administration faces challenges in providing support to Myanmar. I* *WMO had previously provided technical assistance to Myanmar with a focus on capacity building in areas such as severe weather forecasting, seasonal forecasting, and the management of climate and hydrological data. In addition, WMO was also working in Myanmar as part of a regional project, where efforts were focused around developing climate risk management systems, best practices and insurance products for smallholder farmers. However, there has been very limited support towards enhancing the hydrological modelling and flood forecasting capabilities in the country, an area that requires critical attention. Considering these challenges, DMH has strongly emphasized on the urgent need for enhanced hydro-meteorological capacities to improve flash flood forecasting and warning services. Further, considering the status of Myanmar as an FCV country, there is urgent need for targeted support. While upcoming initiatives like the CREWS South Asia project (currently under review) provide an opportunity to leverage regional expertise and complement ongoing efforts, a broader national-level approach is needed to achieve meaningful progress and strengthen Myanmar's overall capacity. A national capacity assessment would establish a much-needed baseline, something that has not been done in several years. The findings from this assessment can inform the development of an implementation roadmap, providing a strategic foundation to secure additional funding for a dedicated national project aimed at strengthening disaster resilience and climate adaptation in Myanmar.* *As there are limited financial mechanisms and resources available to address the current situation, the CREWS ASW provides the perfect window to support some of the immediate challenges around strengthening flash flood forecasting capacity while also providing the opportunity to set up a bigger national level seamless and interoperable EWS project that*

	could link with other ongoing efforts and initiatives in the region. Given the challenges associated with Myanmar being a Least developed Country (LDC) and a FCV country, the national capacity assessment will also consider conflict-sensitivity analysis and approaches. The findings from such analysis will be integrated into the development of the roadmap and action plan for strengthening multi-hazard forecasting and early warning capacities in the country. This approach is expected to provide valuable insights and serve as a model for future projects in similar contexts.
Alignment	*While this project will align with the United Nations (UN) EW4All initiative, in particular its Pillar 2 on detection, observation, monitoring, analysis, and forecasting of hazards, it will also leverage other projects in the region. More specifically, this request will align closely with the CREWS South Asia project that will leverage the South Asia Hydromet Forum (SAHF) and the USAID FFGS project. Given the limited engagement of hydrological experts in SAHF and a current dearth of projects that are engaging with Myanmar, this request would be unique. Further, the project will also try to seek synergies with existing regional mechanisms such as WMO Regional Association II (Asia) working structures, engaging with other key regional organizations and programmes/projects during the implementation process, in particular as part of the assessment process.* *Myanmar had adopted its National Adaptation Programme of Action (NAPA) in 2012 and provides an overview of the main impacts of climate variability on socio-economic sectors and communities in Myanmar, based on vulnerability assessments, expert opinion and traditional knowledge. Between 2015 and 2018, Myanmar developed the Myanmar Climate Change Policy (MCCP) and the Myanmar Climate Change Strategy and Master Plan (MCCSMP) 2018-2030, led by the Environmental Conservation Department (ECD) under the Ministry of Natural Resources and Environmental Conservation (MoNREC). These frameworks identify six key sectors essential for economic and social development, with sectoral master plans guiding climate change adaptation and mitigation investments. Their goal is to foster a climate-resilient, low-carbon, and sustainable future for Myanmar. These documents outline the importance of strengthening climate resilience of key economic sectors and the vulnerable communities against hazards such as floods. This project directly aligns with these national plans by enhancing flood forecasting capacity, with a focus on flash floods, which pose a significant threat to Myanmar. By improving hydrometeorological services, integrating advanced forecasting tools, and transitioning to a more robust early warning system, the project supports national adaptation and disaster risk reduction efforts. The initiative contributes to the country's climate resilience objectives by ensuring timely and actionable flood warnings, reducing disaster-related losses, and strengthening institutional capacities to manage extreme weather events more effectively.*
Timeframe	*The two outputs proposed under the ASW will take place in parallel. The total timeframe for completion of the activities is expected to be around 360 days which is less than a year.*
Action Cost *(To be completed by*	*The table below provides the breakdown of costs and timeframe for the activities under each of the outputs. It should be noted that the two outputs will run in parallel.*

Implementing Partner)	*Activity*	*Budget (USD)*	*Timeframe (days)*
	Output 1: Assessing Hydrometeorological Services through the deployment of National Capacity Assessment Tool (NCAT)		
	Stakeholder engagement & data collection	*2,000*	*15 days*
	Desktop review and pre-population of NCAT	*3,000*	*10 days*
	Mapping of DMH capacity and needs for Early Warning Systems (EWSs)	*5,000*	*15 days*
	Strengths, Weakness, Opportunities and Threats (SWOT) Analysis	*6,000*	*15 days*
	CONOPS (Concept of Operations) framework for Early Warning Systems	*6,000*	*10 days*
	Roadmap for enhancing multi-hazard forecasting and early warning capabilities with clear milestones, timelines and responsibilities	*8,000*	*28 days*
	Validation workshop	*10,000*	*5 days*
	Output 2: Enhancing Flash Flood Forecasting and Early Warning Capabilities		
	Identification of target catchment and Data collection and processing (meteorological, hydrological etc.)	*10,014*	*30 days*
	Enhancing hydrometeorological data exchange through WIS 2.0 and WHOS	*12,023*	*60 days*
	Development of high-resolution flash flood model and training	*107,205*	*180 days*
	Development of nowcasting based on machine learning and training	*16,981*	*30 days*
	Development of bias correction module and training	*20,012*	*30 days*
	Operationalization of forecasting system and integration into visualization portal and training	*15,004*	*30 days*
	Project Support Costs (PSC) @ 13%	*28,761*	
	Total	***250,000***	
Attachments	*[Country Endorsement Letter or similar[1] if submission by Implementing Partner]* *[Detailed Activity List to be provided by Implementing Partner]*		

[1] This can include existing Letters or Frameworks in place between the Implementing Partner and Partner Country or Countries in the event that the scope of engagement includes the specific early warning system Action being requested. For Regional Action requests, the Endorsement Letter or similar existing Letter or Framework can originate from relevant regional institutions.

	[Detailed Budget to be provided by Implementing Partner]

Annex-2 Myanmar Request Letter

Government of The Republic of the Union of Myanmar
Ministry of Transport and Communications
Department of Meteorology and Hydrology
Nay Pyi Taw, MYANMAR

Office No.5
Ministry of Transport and Communications
Department of Meteorology and Hydrology
Nay Pyi taw, Myanmar

Tel: + 95 67 411031/411446
Fax: + 95 67 411449

Email: dg.dmh1@gmail.com
Web Site: www.dmh.gov.mm

Ref: maza-1(04)/1-051(2025)/2123
Date: 17 May 2025

To

Prof. Celeste Saulo
Secretary General
World Meteorological Organization
7 bis, avenue de la Paix,
Case postale 2300
CH-1211 Geneva 2
Switzerland

Subject: Request of support in Assessing Hydrometeorological Services and Updating Flash Flood Early Warning Systems in Myanmar

Dear Prof. Saulo,

At the outset, please allow me to present the compliments of the Department of Meteorology and Hydrology (DMH) of Myanmar.

As you may know, Myanmar, one of the largest countries in Southeast Asia, is highly vulnerable to various natural hazards, including flash and riverine flooding, landslides, cyclones, and storm surges. The Department of Meteorology and Hydrology is the primary agency responsible for monitoring and providing alerts on hydro-meteorological hazards for Myanmar. Within DMH, the Hydrological Division issues daily river-level and flood forecasts along 14 major rivers. This contributes to Myanmar's critical early warning functions aimed at protecting lives and livelihoods and better management of water resources.

DMH has qualified professionals dedicated to fulfilling these important functions. However, there are significant technological and human resource limitations, particularly in impact-based forecasting for hydrological hazards. To address this gap, a standalone Flash Flood Guidance System (FFGS) known as MyanmarFFGS was established with support from the United States Agency for International Development (USAID). This system, as the sole Flash Flood prediction system in Myanmar, provides an indication on flash flood potential and threat and allows for a more rapid mobilization of response agencies (rather than a detailed forecast system which adds complexity and uncertainty to warning development). It should be mentioned that a MyanmarFFGS Steering Committee was held on the 17th of February 2025, were the integration of the standalone MyanmarFFGS to the SAsiaFFGS was requested by Myanmar.

This integration was also positively received and approved by the Regional Centre of SAsiaFFGS (India), inviting Myanmar to participate in the next SAsiaFFGS Steering Committee meeting. However, I have since been informed that due to some recent developments, support for the existing FFGS is currently uncertain.

Following these developments, DMH had a meeting with the FFGS team of the WMO Secretariat to look for alternative solutions and possibilities of cooperation and would like to propose the Assessment of Hydrometeorological Services and Update of Flash Flood Early Warning Systems in Myanmar. Considering the status of Myanmar as a Least Developed Country (LDC), there is urgent need for enhanced hydro-meteorological capacities to improve flash flood forecasting and warning services.

Through this letter, I kindly request support from the WMO Secretariat to assist us in developing a project proposal using the CREWS Accelerated Support Window (ASW) that would address the following priorities:

1. Assessment of Myanmar's DMH capacities using WMO's National Capacity Assessment Tool (NCAT) methodology. The assessment will help inform the development of a roadmap and costed action plan, which can serve as a basis for the development of a larger national-level project to strengthen the different pillars of multi-hazard early warning systems.
2. Piloting of Flash Flood Forecasting and Early Warning System in Tachileik of Maesai River basin which is highly vulnerable to frequent flash floods.

I believe this project would align with the United Nations Early Warnings for All Initiative (UN EW4All) and also leverage other projects in the region such as CREWS South Asia. Given the lack of projects that are engaging with Myanmar, I consider this request to be unique and crucial for strengthening the operational capacities of DMH and supporting national adaptation and disaster risk reduction efforts. This initiative also adheres to the CREWS principles of being people-centered and gender-responsive and consistent with broader climate resilience goals.

We look forward to collaborating with WMO to develop this proposal. I am committed to working together to achieve our shared goals of climate resilience and sustainable development.

Yours sincerely,

Director General
Dr. Kyaw Moe Oo
Permanent Representative of Myanmar with WMO
Department of Meteorology and Hydrology
Nay Pyi Taw, Myanmar
dg.dmh1@gmail.com/ kyawmoeoo39@gmail.com/
Tel: +95 67 411031, Fax: +95 67 411449

Annex-3 Timeline for implementation

Output/Activity	Months											
	1	2	3	4	5	6	7	8	9	10	11	12
Output 1: Assessing Hydrometeorological Services through the deployment of National Capacity Assessment Tool (NCAT)												
1.1 Stakeholder engagement & data collection	X											
1.2 Desktop review and pre-population of NCAT	X	X										
1.3 Mapping of DMH capacity and needs for Early Warning Systems (EWSs)		X	X									
1.4 Strengths, Weakness, Opportunities and Threats (SWOT) Analysis			X									
1.5 CONOPS (Concept of Operations) framework for EWSs			X									
1.6 Roadmap for enhancing multi-hazard forecasting and early warning capabilities with clear milestones, timelines and responsibilities		X	X									
1.7 Validation workshop			X									

Output/Activity	Months											
	1	2	3	4	5	6	7	8	9	10	11	12
Output 2: Enhancing Flash Flood Forecasting and Early Warning Capabilities												
2.1 Identification of target catchment and Data collection and processing (meteorological, hydrological etc.)	X	X										
2.2 Enhancing hydrometeorological data exchange through WIS 2.0 and WHOS		X	X									
2.3 Development of high-resolution flash flood model			X	X	X	X	X	X	X	X		
2.4 Development of nowcasting based on machine learning					X	X	X	X				
2.5 Development of bias correction module								X	X	X		
2.6 Operationalization of forecasting system and integration into visualization portal									X	X	X	
Final project report											X	X

Annex-4 NCAT Brochure

National Capacity Assessment Tool (NCAT)

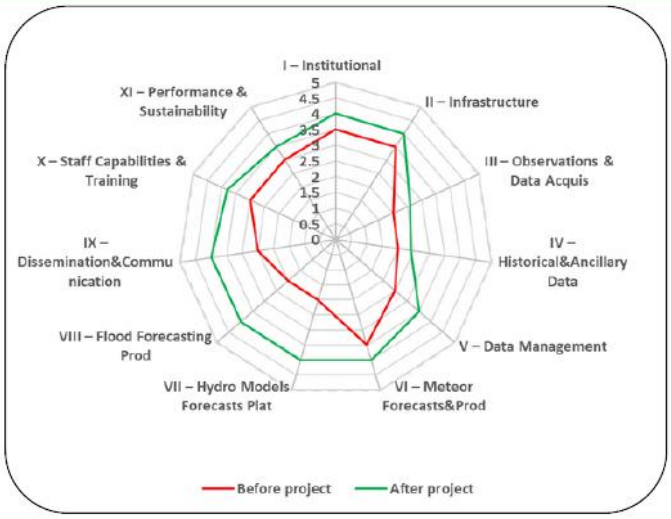
WMO Member Countries consistently identify water-related challenges as one of their main priorities in the context of sustainable development, adaptation to climate change, and disaster risk reduction efforts. Countries with inadequate monitoring and forecasting systems are disproportionately affected by floods, flash floods, and droughts, making them particularly vulnerable. Hydrological information, including relevant status and outlook products, early warning systems (EWS), are required to address these challenges.

In response to this need, the WMO developed NCAT to asses existing challenges and provide solution through roadmap

Why WMO is building NCAT?

To address the increasing challenges of hydrological hazards and to understand current gaps for better designing EWS, the NCAT should be undertaken. As a result, the NCAT roadmap contains a diagnostic of the current EWS, and a phased short-, mid-, and long-term implementation plan, a concept of operations (CONOPS) for EWS, and a SWOT analysis.

NCAT assessment of early warning system components should be conducted before and after project realization



Global NCAT Status

Assessment: 27 countries **Completed: 23 countries** **Ongoing: 4 countries**



2023-2024: Iran, Ethiopia, South Sudan, Sudan, Rwanda and Uganda

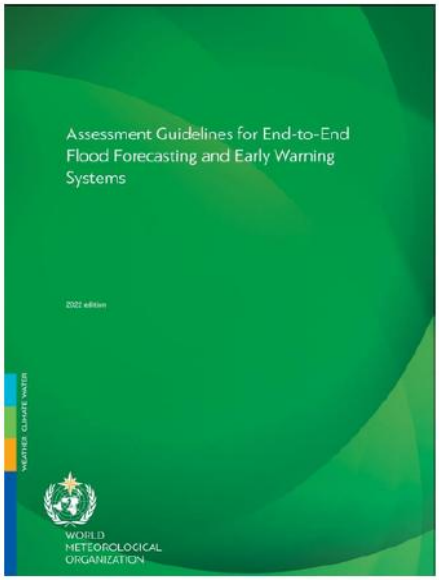
WORLD METEOROLOGICAL ORGANIZATION

What is NCAT?

NCAT integrates various guidelines:

- WMO No. 1286 "Assessment Guidelines for End-to-End Flood Forecasting and Early Warning Systems";
- the Global Hydrological Status and Outlook System (HydroSOS);
- the Multi-Hazard Early Warning System (MHEWS) Checklist;
- other relevant WMO Technical Guidelines.

By incorporating data from the WMO Country Profile Data(CPDB) and WMO Information System, NCAT evaluates and verifies the existing capacities and capabilities of **Hydrological Services within the MHEWS environment.**



Objectives

- **Standardize Benchmarking:** Develop and implement a standardized benchmarking tool based on well-established WMO Guidelines.
- **Identify Service Gaps:** Conduct capacity assessments to identify gaps and benchmark the status of hydrological services.
- **Action Plans and Roadmaps:** Develop country-specific action plans and roadmaps to enhance hydrological services.
- **Knowledge Management:** Strengthen knowledge management by establishing a Community of Practice for disseminating assessment findings.
- **Quality Control:** Review assessment results, enhance quality control, and improve WMO Information Systems for better monitoring and evaluation of National Hydrological Services.
- **Policy Support:** Provide continuous policy and decision-making support based on updated, expert-validated assessment results.

NCAT application flowchart

Step 1: Evaluating the capabilities of National Services using WMO Assessment Guidelines.

Step 2: Country validation.

Step 3: Develop CONOPS and Roadmap.

Step 4: CONOPS and Roadmap Submission for Implementation to build *Seamless and Interoperable EWS*

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