CONCEPT NOTE FOR REGIONAL PROJECT/PROGRAMME

PART I: PROJECT/PROGRAMME INFORMATION

Title of Project/Programme: Scaling up Integrated Flood and Drought Management and Early Warning System for climate change adaptation in the Volta Basin Countries (VFDM-Phase 2)

Countries: Côte d'Ivoire and Ghana

Thematic Focal Area[1]: Disaster risk reduction and early warning systems

Type of Implementing Entity: Multilateral Implementing Entity

Implementing Entity: World Meteorological Organization (WMO)

Executing Entities : World Meteorological Organization (WMO), Société d'exploitation et de développement aéroportuaire, aéronautique et météorologique (SODEXAM) and Ghana Meteorological Agency (GMet),

Amount of Financing Requested: 19,360,000 USD (in U.S Dollars Equivalent)

Project Formulation Grant Request: Yes ☒ No ☐

Amount of Requested financing for PFG: 100,000 (in U.S Dollars Equivalent)

Letters of Endorsement (LOE) signed for all countries: Yes ☒ No ☐

NOTE: LOEs should be signed by the Designated Authority (DA). The signatory DA must be on file with the Adaptation Fund. To find the DA currently on file check this page: https://www.adaptation-fund.org/apply-funding/designated-authorities

Stage of Submission:

☒This proposal has been submitted before including at a different stage (pre-concept, concept)

☐ This is the first submission ever of the proposal at any stage
In case of a resubmission, please indicate the last submission date: 12/8/2025

[1] Thematic areas area: Food security; Disaster risk reduction and early warning systems; Transboundary water management; Innovation in adaptation finance.

Project/Programme Background and Context:

PROJECT OVERVIEW

West Africa continues to be one of the most vulnerable regions for water-related disasters and the far-reaching impacts of climate change. The targeted countries comprising the Volta basin region span diverse climatic zones from semi-arid to sub-humid areas which are highly susceptible to hydrometeorological hazards. Over the past two decades, nearly two million inhabitants in the Volta Basin alone have been impacted by floods, with approximately 68% of the basin's population relying on agriculture, making them particularly vulnerable to climate-induced disasters2. In recent years, the region has experienced a significant uptick in the frequency and severity of hydrometeorological hazards. In 2022, West and Central Africa experienced the worst flooding in years, affecting 8.2 million people across 20 countries, including the targeted project countries (OCHA, 2022). In 2024, torrential rains and severe flooding continued to impact the region, with over 716,000 people affected in countries such as Côte d'Ivoire, Ghana, and Togo[3],[4] leading to the destruction of crops, displacement of communities, and collapse of socio-economic infrastructure in vulnerable rural areas coupled with the drought episodes in Côte d'Ivoire and Ghana between 2021 and 2023[5]. Ghana faced a severe drought in 2024, impacting over 928,000 farmers and leading to substantial crop failures in regions such as Upper West, Bono East, and Northern Ghana. Key staples like maize, rice, groundnut, soybean, sorghum, millet, and yam suffered from water stress, resulting in an estimated investment loss of GH¢3.5 billion (US$ 238,907,849.83) and a revenue loss of GH¢10.4 billion (US$ 709,897,610.92)[6] (Minister for Food and Agriculture, 2024).
In the Northern Region of Ghana, approximately 460,784 hectares—60% of cultivated land—were affected by dry spells, severely impacting staple crops. Overall, in Côte d'Ivoire during 2023, cotton production nearly halved compared to the previous season due to drought-induced pest outbreaks, resulting in damages estimated at US$60 million7. Both flood and drought impacts have underscored the urgent need to enhance local resilience and integrate adaptation measures at both national and transboundary levels. The reliance on agriculture for livelihoods by the majority of the population for livelihoods means that extreme weather events such as floods and droughts have devastating effects on food security and income. Moreover, poverty-induced migration to urban areas has led to the proliferation of informal settlements in flood-prone zones, exacerbating the risks of floods and landslides. In Ghana, key issues include rising sea levels, prolonged droughts, higher temperatures, and erratic rainfall patterns intensifying food insecurity and agricultural stress. Coastal urban areas like Accra are highly vulnerable to flooding and associated health risks, while unpredictable rainfall and drought have destabilized hydro energy supply.

Over the next 30 years, extreme hydrometeorological events in West Africa are projected to intensify due to climate change. The Intergovernmental Panel on Climate Change (IPCC) 2022 report indicates that Africa has experienced widespread warming, with accelerated trends and climate impacts[8],[9] in recent decades. Projections suggest a further temperature increase of +1.5°C to 3°C by 2050. This warming is expected to lead to increased intensity of heavy precipitation events and more frequent drought occurrences, substantially heightening hydroclimatic stress on populations in West Africa during the late 21st century. Overall, dry seasons are expected to be longer and drier, while rainy seasons are going to be shorter but characterized by more intense precipitation events. Combined with the socio-economic context—where a majority of people depending on rain-fed agricultural production and internal migration towards urban centers not equipped to absorb additional populations—this will lead to hampered food security situation, loss of income and livelihoods for farmers, and increase in populations living in informal settlements located in flood-prone urban areas.

Following the rapid assessment conducted for the EW4All initiative in Ghana as shown under Figure 1, it is observed that floods and droughts are priority hazards and with the maturity score of 3 as compared to the lobal average, there is need or gaps which requires support especially improving infrastructures, warning products and systems (monitoring and impact-based forecasting) and capacity development at the national level.

Similar gaps and needs exist for Côte d'Ivoire to strengthen their Early Warning System (EWS) for timely monitoring of the hydro-meteorological hazards and supporting early warning services to various stakeholders including the population.

All these challenges underscore the need to enhance local resilience and integrate adaptation measures at both national and transboundary levels. In response, national governments and regional institutions are advocating for integrated, locally driven, and technically robust adaptation strategies. These strategies emphasize early warning systems, community-based disaster risk management, and transboundary water governance.

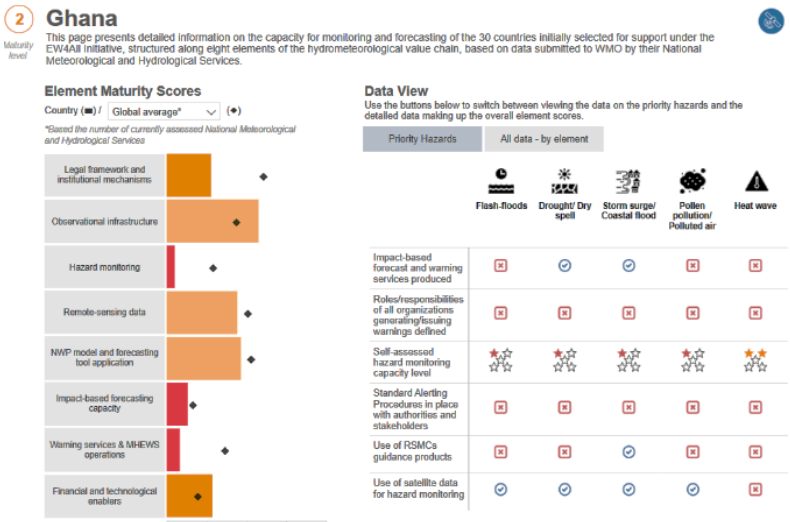


Figure 1 EW4All rapid assessment result for Ghana https://earlywarningsforall.org/site/early-warnings-all/dashboards/early-warnings-all-dashboard

Additionally, there is a need for improving and complementing the adaptation plans, projects and policies on the climate-based threats especially floods and drought events in the Volta Basin region. At the national level, Volta Basin countries have developed or are implementing National Adaptation Plans (NAPs) and National Adaptation Programmes of Action (NAPA), bolstering climate change adaptation efforts. Furthermore, all the targeted project countries have incorporated activities on integrated water resources management, early warning and climate adaptation in their Intended nationally

2 Volta Flood and Drought Management project information: https://www.adaptation-fund.org/project/integrating-flood-drought-management-early-warning-climate-change-adaptation-volta-basin-benin-burkina-faso-cote-divoire-ghana-mali-togo/#:~:text=The%20geographic%20setting%20of%20the,is%20largely%20dependent%20on%20agriculture.
[3] ACMAD – Floods in the Sahel https://acmad.org/wp-content/uploads/2019/03/Information_Note_flood.pdf
[4] UNICEF Humanitarian Crisis Report No.1. Sahel Crisis.
[5] Adaptation Fund. (2023). *Annual Report on Climate Resilience Initiatives in West Africa.*
[6] UN exchange as at 31 December 2024 when 1 US$ = 14.65 GH¢
[7] Portail Officiel du Gouvernement de Côte d'Ivoire. Soutien a la filiere coton: 34,52 milliards de FCFA de subvention de l' Etat aux cotonculteurs pour la campagne 2022-2023 (02/03/2023). https://www.gouv.ci/_actualite-article.php?recordID=14675 and https://thebftonline.com/2024/09/11/dry-spell-affects-60-of-farms-in-northern-region/
[8] UNDP. (2022). *Building Resilience in West Africa: A Pathway to Sustainable Development.* New York: United Nations Development Programme.
[9] World Bank. (2023). *Climate Change and Water Resources in West Africa: Vulnerabilities and Adaptation Strategies*. Washington, DC: World Bank Group

determined contributions (INDCs). The table 1 below summarizes the INDC contributions of the targeted countries in areas pertinent to the proposed project.

Table 1 : INDC status and support to the targeted countries of the Volta Basin region

NDC contributions to	Côte d'Ivoire	Ghana
Agricultural productivity	☒	☒
Integrated Water resources management	☒	☒
Enhance early warning and disaster risk management	☒	☒
Forest and land-use	☒	☒
Coastal Zone Management	☒	☒
Institutional and capacity development		☒

Source: UNFCCC NDC Registry. https://unfccc.int/NDCREG

To mitigate natural hazards related to extreme events of flood and drought in the targeted Volta basin countries, the Volta Flood and Drought Management (VFDM) project was initiated in June 2019 and concluded in June 2024, covering the areas within the Volta Basin only, not the entire countries constituting the volta basin (Benin, Burkina Faso, Côte d'Ivoire, Ghana, Mali and Togo). Funded by the Adaptation Fund with a budget of USD 7.92 million, the project was a collaborative effort among the World Meteorological Organization (WMO), the Volta Basin Authority (VBA), and the Global Water Partnership West Africa (GWP-WA). The VFDM project achieved significant milestones in integrated flood and drought management, providing valuable insights and laying a solid foundation for enhancing resilience in the region.

Key accomplishments include:

- Development of Early Warning Systems: The VFDM improved knowledge of flood and drought risk in the basin through the established VOLTALARM Early warning System[10]. This system has improved access to impact-based forecasts and warning services (more than 80 warning or advisory bulletins have been issued from 2022) for at least 23 million people across the Volta Basin region of the six basin countries. This significantly reduced the number of casualties and livelihood impacts due to floods and drought by providing timely forecasts and warnings to populations at risk, which allowed communities to evacuate safely. For example, in Côte d'Ivoire, the lead time for flood forecasting increased from 24 to 48 hours, allowing more time for communities to prepare. In Ghana, GMet previously only provided weather forecasts to the various stakeholders including the general population. Following the implementation of the VFDM project, GMet is issuing the impact-based forecasts which include information on potential impacts of rainfall and river flows on the population and agriculture.

- Capacity Building for flood and drought management including nature-based solutions and community-based approaches with gender mainstreaming: Through targeted training and stakeholder engagement, the project enhanced the technical and operational capacities of national institutions and local communities, leading to more effective disaster risk management. Over 750 young professionals[11] were trained, including national meteorological and hydrological staff, enabling better flood forecasting and response.

- Policy and Institutional Strengthening: The project strengthened regional cooperation among the six Volta Basin countries through joint activities, data-sharing platforms, and the development of a shared early warning system for flood and drought management.

Building upon the successes and lessons learned from the VFDM project, there is a compelling need to expand and deepen these efforts. In view of the evolving climate risks and in an effort to extend early warnings to all, the new phase of this initiative seeks to extend its scope beyond the volta basin catchments, to cover the entire countries of firstly Côte d'Ivoire and Ghana (as for other Volta Basin countries there are other projects in the other countries funded by World Bank and Climate Risk and Early Warning System (CREWS)) which is estimated to benefit more than 30 million inhabitants[12].

Background

1.1 Geographical and Hydroclimatic context

This project will cover two countries (Ghana and Côte d'Ivoire) of the Volta Basin located in West Africa between 4°N to 11°N latitude and 9°W to 1°15′E longitude (Figure 2), with a total area of approximately 561,000 km². Table 2 provides an overview of demographic for Ghana and Côte d'Ivoire, including urbanization trends, and geographic settlement patterns as of 2024.

Table 2 Demographic and Settlement Characteristics of Ghana and Côte d'Ivoire

Category	Ghana	Côte d'Ivoire (Ivory Coast)
Estimated Population (2024)	~34 million	~30 million
Population Growth Rate	~2.1% per annum	~2.3% per annum
Major Ethnic Groups	Akan (47.5%), Mole-Dagbani (16.6%), Ewe (13.9%), Ga-Dangme (7.4%)	Akan (42.1%), Voltaiques (17.6%), Northern Mandé (16.5%)
Urban Population (%)	~58% (increasing steadily)	~53% (increasing rapidly)
Major Cities (Population)	Accra (~2.7M), Kumasi (~3.3M), Tamale (~950K), Takoradi (~450K)	Abidjan (~5.4M), Bouaké (~1M), Daloa (~460K), San Pedro (~350K), Yamoussoukro (~270K)
Urban Composition	Coastal and inland cities; Accra (coastal), Kumasi (inland)	Primarily coastal and southern cities; Abidjan dominates

[10] https://volta.mydewetra.world/
[11] WMO 2024 ; Volta Flood and Drought Management Deliverables - https://www.floodmanagement.info/volta-basin/deliverables/
[12] Combined population of the countries of the Volta basin as of 2023, https://data.worldbank.org/indicator

Category	Ghana	Côte d'Ivoire (Ivory Coast)
Settlement Patterns	- Densely populated southern belt- Major settlements along Gulf of Guinea coast and Volta River- Inland settlements in Ashanti & Northern Regions	- Heavily concentrated along the coast, especially Abidjan- Dense settlements along rivers like Bandama and Comoé- Sparse in northern savannah areas
Coastal Settlements	Accra, Takoradi, Cape Coast	Abidjan, San Pedro, Grand-Bassam
Riverine Settlements	Along the Volta River: Akosombo, Ada Foah	Along Bandama River: Bouaké, YamoussoukroComoé River towns
Rural-Urban Migration Trends	High — driven by job opportunities, education, and amenities	High — mainly towards Abidjan and coastal economic zones
Demographic Structure	Youthful population: ~38% under 15 years	Youthful population: ~41% under 15 years
Population Density (2024)	~138 people/km²	~82 people/km²

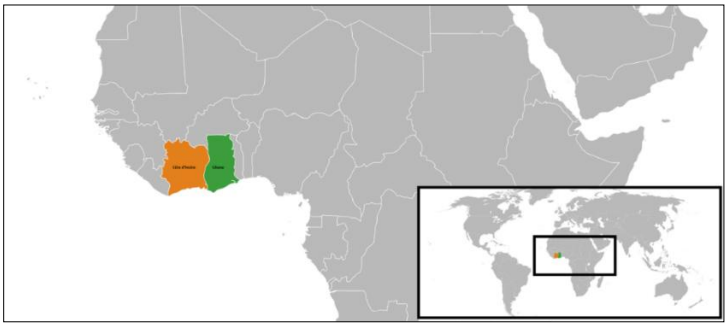


Figure 2 Project Location - 2 of the countries of the Volta Basin, Côte d'Ivoire and Ghana

Ghana and Côte d'Ivoire are neighboring West African countries with rich river systems that play vital roles in their ecology, economy, and culture. Many of their rivers either originate in one country and flow into the other or form natural boundaries between them as shown in Figure 3.

Rivers in Ghana:

- Volta River: The most important and largest river in Ghana. It's formed by the confluence of the Black Volta (Mouhoun) and White Volta (Nakanbe) rivers in the north and flows south into the Gulf of Guinea. The Akosombo Dam on this river has created Lake Volta, one of the largest man-made lakes in the world, which supplies hydroelectric power to much of Ghana.
- Pra River: Flows southward into the Atlantic Ocean. It's significant for local communities and known for small-scale gold mining along its banks.
- Ankobra River: Also flows to the Atlantic, important for fishing and transport in the Western Region.
- Tano River: Originates in Ghana, flows into Côte d'Ivoire, and eventually empties into the Atlantic Ocean. It is vital for communities on both sides of the border.

Rivers in Côte d'Ivoire:

- Bandama River: The longest river in Côte d'Ivoire, running about 800 km from the north to the south into the Gulf of Guinea. It passes through the country's capital, Yamoussoukro.
- Comoé River: Originating from Burkina Faso, it flows through northern and southeastern Côte d'Ivoire, emptying into the Atlantic. It supports rich biodiversity, especially in Comoé National Park.
- Sassandra River: Flows from the northwest to the Atlantic in the southwest. It is used for fishing and local irrigation.
- Cavally River (Cavalla): Acts as a natural border between Côte d'Ivoire and Liberia. It flows southwest into the Atlantic Ocean.

Shared rivers

- Tano River: As mentioned, this river flows between Ghana and Côte d'Ivoire, serving both as a resource and a cross-border link.
- Bia River: Another important river rising in Ghana and flowing into Côte d'Ivoire. It is crucial for cocoa farming regions and local communities.

Mouhoun and Oti rivers are respectively part of the borders between Ghana, Burkina Faso and Ivory Coast for the former and between Togo, Benin, Ghana and Burkina Faso for the latter.

Source: CILSS (2016)

Figure 3 Major rivers in West Africa region

Figure 4: Bioclimatic regions of West Africa (CILSS, 2016; Landscapes of West Africa

The climate in the targeted countries is highly variable with the North-East Trade Winds which are dry and dusty and the South-West Monsoon which are moist. The interface of these two air masses is called the Inter-tropical Convergence Zone (ITCZ) which leads to high variability of floods and droughts. The rainfall in the region is highly variable, both spatially and temporally, increasing from north to south. The spatial distribution of rainfall has been used to define bio/agro-climatic zones. The project area comprises 3 climatic zones ranging from the humid tropical rainforest zone (Guineo-Congolian) in the South, to humid semi-deciduous forest zone (Guinean), changing into the sub-humid savanna zones (Sudanian) as shown in Figure 4. Consequently, the mean annual temperature ranges from 27°C in the coastal south to 30-32°C in the inland parts, with March the hottest month of the year. Within the Volta basin, evaporation rates are variable in time and space and range from 1,176 to 2,400 mm per annum.

Table 3 Climate zones in the targeted Volta basin Countries. Source: CILSS, 2016[13]

Climate zone	Average annual rainfall	Characteristics
Sudanian zone	600 - 1200 mm	1 rainy season (May-October) Dry season of 5-7 months Vegetation – Savanna (including open tree savannas, wooded savannas, open woodlands)
Guinean zone	1200 - 2200 mm	2 rainy seasons (April-July and September – October) 75% of the rain falls between April and July. Vegetation -seasonally wet-and-dry deciduous or semi-deciduous forest.
Guineo-Congolian zone	2200 – 5000 mm	2 rainy seasons (April – July and September-October) or year-round rainfall with short drier periods between the rains.

Environmental and ecosystem context

The targeted Volta basin countries feature diverse ecosystems, including savannahs, forests, and wetlands that underpin regional food security and economic activities. These ecosystems provide critical services such as water, climate regulation, and flood control, while also serving as habitats that sustain the biodiversity of the region[14]. The Upper Guinea ecosystem, which includes parts of Côte d'Ivoire, Ghana, Togo, and Benin, is a biodiversity hotspot, underscoring the area's ecological significance. The sustainability of these resources is essential for the well-being of over 60 million people living in the targeted countries for day-to-day activities. However, the Volta Basin faces significant environmental challenges. Along the river courses, more than 1180 small reservoirs have been built in the Volta basin. Their water quality has been deteriorating due to harmful water nutrients resulting from land degradation and through the usage of pesticides and fertilizers for agricultural growth, as well as contamination from mining activities, which often release heavy metals and toxic substances into rivers and groundwater systems. Rapid urbanization is leading to inappropriate discharges of domestic waste into the streams and rivers, degrading the quality of the water. Moreover, water quality is deteriorating due to phosphates and nitrates from agriculture, untreated sewage, and unsustainable land use. Land and ecosystem degradation occur because of deforestation, overgrazing, and bushfires, which reduce vegetation cover and lead to soil erosion. These factors exacerbate the impacts of natural hazards like floods and droughts, which are intensified by climate change. Addressing these issues is critical to maintaining the health and productivity of the basin's ecosystems.

The vulnerability in the West African countries is not only increasing because of social changes but also through environmental stresses due to modification of natural hazards, environmental degradation, climate change and losses of natural resources and biodiversity. These stresses have a major impact on the livelihood of the most vulnerable population (security, health condition economic opportunities) as highlighted in Figure 5. Climate change poses a severe threat to the Volta Basin, with projections indicating an increase in the frequency and intensity of extreme weather events in the region, this will further endanger ecosystems, agriculture, and water resources, potentially leading to food insecurity and economic instability[15]. Specific considerations to reduce vulnerability include supporting efforts to maintain soil quality, to enhance productivity and increase capacity to deal with environmental variation; planning for adequate water supply and sanitation to meet both urban and rural populations' needs.

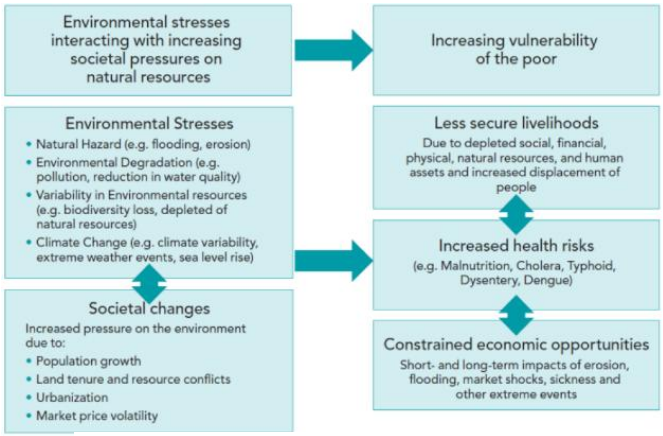


Figure 5: Vulnerability Profile of West Africa

Socio-economic context

Agriculture remains a major economic driver in the region, employing a significant portion of the population and contributing substantially to Gross Domestic Product (GDP). Côte d'Ivoire and Ghana are the world's leading cocoa producers[16]. Table 4 highlights the GDP figures for the targeted countries, falling in lower middle-income categories. Ghana and Côte d'Ivoire experience relatively higher GDP growth compared to other Volta basin countries [17]. Ghana benefits from oil and gold production, while Côte d'Ivoire has a robust agribusiness sector and strong regional trade links.

Table 4 Gross domestic Product (GDP) for targeted countries in the Volta Basin (2023)

Country	*GDP in 2023[18] (billion USD)*	*GDP per Capita*	*GDP growth rate*
Côte D'Ivoire	78.88	2530.8	Côte d'Ivoire's economy grew by **6.5%** in 2023, with projections to maintain an average growth rate of **6.5%** for 2024–2025.
Ghana	76.37	2260.3	Ghana's economy grew by **5.7%** in 2024, a significant rebound from previous years of economic challenges.

Source: https://data.worldbank.org/indicator

[13] CILSS, 2016. Landscape of West Africa. A window on a changing world. Geological Survey Eros, Garretson, SD.
[14] VFDM Activity 1.2.3.6 Report. General guidance to promote ecosystem services in the Volta Basin.

[16] Food and Agriculture Organization (FAO). (2022). *State of Food and Agriculture in West Africa*.
[17] International Monetary Fund (IMF). (2023). *Regional Economic Outlook: Sub-Saharan Africa*.
[18] https://data.worldbank.org/indicator/NY.GDP.MKTP.CD

More so, the losses attributed to extreme hydroclimatic events like floods and drought are very significant to the GDP[19]. An assessment of flood and drought impact in West Africa by Economic Community of West African States (ECOWAS) showcased that flood damages are much higher with an extensive impact on communities, despite affecting fewer people than drought[20]. In 2021, 22.9 M people were affected by floods in the West African countries compared to 77.4 M people by drought. However, flood avoided damages are higher compared to drought crop yield response.

Food security remains a pressing concern in the volta basin region. According to the 2023 Global Hunger Index (GHI), Ghana ranks in the "moderate" category[21]. Factors contributing to food insecurity include climate variability, conflict, and economic instability. Persistent challenges such as inflation, limited industrialization, and external debt burdens also affect economic stability. In addition, a large part of the electricity on which the economy depends is generated from hydropower, which has been affected by climate conditions. Droughts can lead to low levels of water in the dams while floods and extreme rainfall can damage hydropower infrastructure. For the energy sector, changes in energy consumption have been estimated through differences between the dry and wet periods. Dry periods are related to warmer temperatures (for example, harmattan, bringing hot and dusty air from the Sahara to the coastal areas of West Africa) and thus higher demand for air-conditioning and cooling. An increase in regulation and more integrated water management will contribute to a reduction in the differential elasticity.

Climate Change in West Africa: Trends, Impacts, and Projections

Past and present climate change

West Africa is one of the most climatically variable regions in the world, experiencing fluctuations on intra-seasonal to inter-decadal timescales. West Africa has experienced significant climatic changes over the past several decades, with increasing temperatures, shifting precipitation patterns, and more frequent extreme weather events. Observed data indicates that mean annual and seasonal temperatures have risen by 1–3°C since the mid-1970s, with the highest increases recorded in the Sahara and Sahel regions. Maximum and minimum temperature trends have been rising at rates of 0.16°C and 0.28°C per decade, respectively, leading to more frequent heatwaves. Additionally, the number of very hot days (above 35°C) and tropical nights has increased, further exacerbating heat stress across the region. These warming trends have serious implications for water availability, agriculture, and human health.

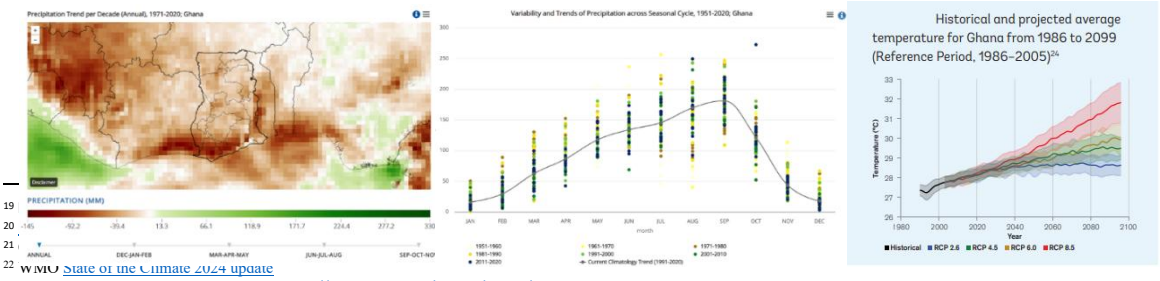
Precipitation patterns in West Africa have also undergone significant shifts, characterized by increased interannual variability and extremes. Between the 1960s and 1980s, a marked decline in rainfall was observed, attributed to the combined effects of anthropogenic aerosols and greenhouse gas (GHG) emissions. However, this trend reversed in the mid-1990s, with a shift toward wetter conditions accompanied by fewer but more intense rainfall events. The Sahel and the Gulf of Guinea regions have seen a rise in extreme precipitation, leading to an increase in mesoscale storms and high-flow events in large Sahelian rivers. These changes have intensified the risk of flooding and water-related disasters. Precipitation trends are more complex due to seasonal and spatial variations. A growing climate divide has been observed, with the western Sahel experiencing drier conditions and the eastern Sahel receiving increased rainfall. A notable recent example of extreme flooding occurred in the Sahel region in September 2024, when excessive rainfall submerged 113,619 hectares of cropland in Mali, displacing approximately 26,000 people[22]. Moreover, West Africa's climate is strongly influenced by large-scale atmospheric and oceanic phenomena such as the El Niño-Southern Oscillation (ENSO). El Niño events, characterized by higher-than-average sea surface temperatures in the eastern tropical Pacific, are associated with increased heat and droughts in some areas, while La Niña typically results in cooler temperatures and shifts in precipitation patterns. These oscillations contribute to year-to-year variability in weather extremes, compounding the long-term challenges posed by climate change. In 2023, accumulated precipitation totals in 2023 were above the long-term average in parts of West Africa from assessments of the state of the global climate by WMO[23]. Rising sea levels have been recorded along the West African coastline, with Takoradi, Ghana, recording a 25 cm rise since the 1930s.

Past Climate Change Impacts

The observed changes in climate have already begun to manifest in the form of extreme weather events, ecosystem disruptions, and economic hardships. More intense and frequent rainfall patterns shown in Figure 6 cause widespread destruction of infrastructure, livelihoods, and ecosystems, making adaptation efforts increasingly critical. The region is highly susceptible to climate change impacts due to its dependence on rainfed agriculture and limited institutional capacity to adapt.

Records of past climate change impacts include:

- **Drought and flood impacts on agriculture**: Between 2000 and 2009, climate-induced droughts and rainfall extremes in West Africa reduced millet and sorghum yields by 10–20%, and 5–15% respectively [24]. Increased temperatures have heightened evapotranspiration, intensifying water stress and reducing soil moisture availability.
- **Flood induced damages:** From 2005–2020, flood-induced damage over Africa was estimated at over USD 4.4 billion, with eastern and western Africa being the most affected regions[25]. Total damages in four west African countries (Benin, Côte d'Ivoire, Senegal and Togo) in 2017 were estimated at USD 850 million for pluvial floods and USD 555 million for fluvial floods
- **Health**: Rising temperatures have contributed to an increase in heat-related illnesses and mortality. Malnutrition rates have risen due to declining agricultural yields, where climate-related crop failures have led to increased child mortality rates (Zida et al, 2020).
- **Sea-Level Rise**: Coastal erosion and saltwater intrusion threaten key urban centers. Rising sea levels have increased the vulnerability of coastal communities, leading to displacement and destruction of infrastructure.
- **Migration:** In Ghana's Northern and Upper East regions, communities along the White Volta are regularly displaced during heavy rains and the opening of spillways from the Bagre Dam in Burkina Faso.



[19] WMO State of the Climate 2024 update

[20] WMO State of the Global Climate 2023, https://library.wmo.int/viewer/68835/download?file=1347_Global-statement-2023_en.pdf&type=pdf&navigator=1

[21] IPCC. Climate Change 2022: Impacts, adaptation and Vulnerability Climate Change 2022: Impacts, Adaptation and Vulnerability | Climate Change 2022: Impacts, Adaptation and Vulnerability

[22] EMDAT and CRED, 2020. *Flood-Induced Damage Estimates in Africa.*

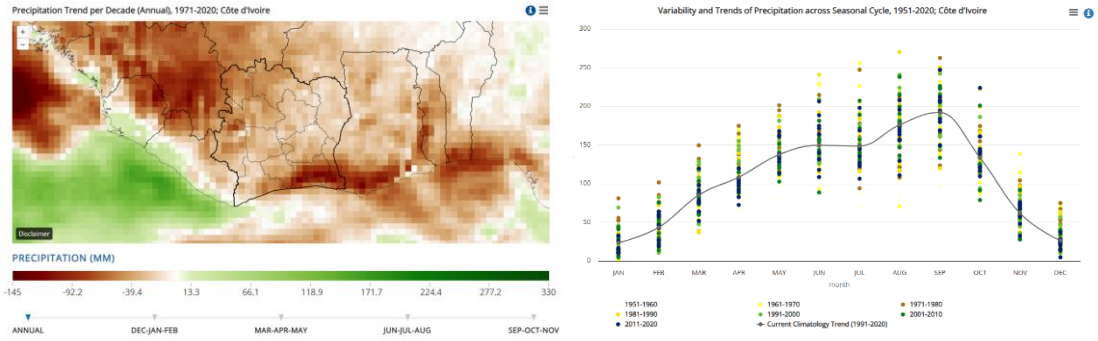


Figure 6 Graphs displaying historical temperature and precipitation trends for Ghana and Côte d'Ivoire over the past century, highlighting warming patterns and rainfall variability[26]

Climate Change Projections

Projections indicate that temperatures in West Africa will continue to rise faster than the global average throughout the 21st century as shown under Figure 7. By 2050, temperatures are expected to increase between +1.5°C to 3°C, and by the end of the century, they could rise between +3°C to 6°C, with the Sahel experiencing the greatest warming. Hot days and prolonged heatwaves will become more frequent, lasting 6 to 28 days longer than in previous decades.

Precipitation projections remain uncertain due to inconsistencies in climate models. However, most models predict decreasing rainfall for the Western Sahel and increasing rainfall for the Eastern Sahel. Specifically[27];

- Western Sahel: Expected rainfall changes ranging between from -16% to +6%.
- Heavy Rainfall: Expected to intensify, with a 1-43% increase in frequency and a 1-12% rise in intensity by 2050.
- Droughts: Meteorological droughts are projected to double in duration in the western Sahel by 2050 under high-emission scenarios.
- Sea-Level Rise: Expected to increase by 13 cm to 56 cm over the century, exacerbating coastal erosion and flooding risks.
- At 2°C global warming, west Africa is projected to experience a drier, more drought-prone and arid climate, especially in the last decades of the 21st century. The duration of meteorological drought in the western parts of West Africa is projected to increase from approximately 2 months during 1950–2014 to approximately 4 months in the period 2050–2100 under RCP8.5 and SSP5-8.5 (Ukkola et al., 2020). Increased intensity of heavy precipitation events combined with increasing drought occurrences will substantially increase the cumulative hydroclimatic stress on populations in west Africa during the late 21st century.

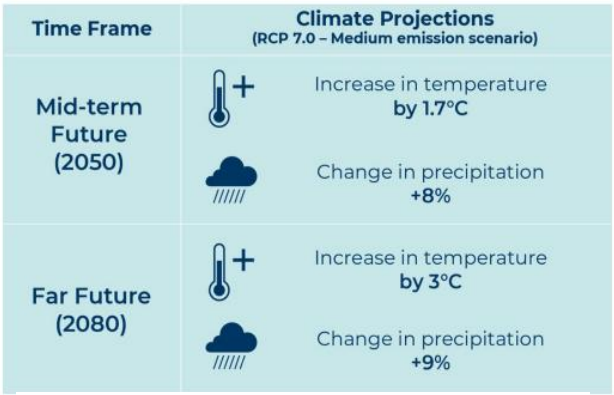


Figure 7 Risk profile developed for current and project climate under the VFDM project. Volta Risk Profile 2022

Projected Impacts of Climate Change

An ensemble of eight bias-adjusted Global Climate Models (GCMs), based on the Inter-Sectoral Impact Model Intercomparison Project (ISIMIP3b) (Huber et al., 2014, Warszawski et al., 2014) under consideration of the two state-of-the-art radiative forcing scenarios ssp126 (based on RCP 2.6) and ssp370 (based on RCP 7.0) are used to assess the impacts of climate change in the Volta River basin. The two scenarios, ssp126 and ssp370, represent different socio-economic developments as well as different pathways of atmospheric greenhouse gas concentrations, leading to different paths of temperature and precipitation development over the 21st century. By about 2040, however, the trends differ little. Substantial differences generally become apparent only from the middle of the 21st century onward.

The projected changes in climate will have significant socio-economic and environmental consequences:

- Agriculture & Food Security: Warming above 2°C is projected to reduce staple crop yields by 20-40% across West Africa. Sorghum and maize yields will decline, leading to food shortages and higher food prices (IPCC, 2022). Crop growing seasons will shorten, and water availability during the dry season will decrease.
- Health Risks: By 2060, heatwave-related mortality risk will be 6-9 times higher than in 1950-2005. By 2100, child malnutrition-related mortality in Burkina Faso could double if warming reaches 1.5°C above pre-industrial levels.
- Urbanization & Migration: Urban populations exposed to severe droughts in West Africa will increase by 65±34 million at 1.5°C warming, further exacerbating food and water shortages. Climate-driven migration is expected to rise, with 56-86 million people migrating internally by 2050 due to climate-induced stressors.
- Infrastructure & Economy: Increased frequency and intensity of flooding will lead to significant economic losses, with potential damages exceeding USD 4.4 billion over the next few decades. Transportation networks and urban centers will face disruptions, affecting trade and commerce.

[26] Source: World Bank https://climateknowledgeportal.worldbank.org/country/cote-divoire/trends-variability-historical
[27] IPCC. Climate Change 2022: Impacts, adaptation and Vulnerability Climate Change 2022: Impacts, Adaptation and Vulnerability | Climate Change 2022: Impacts, Adaptation and Vulnerability

The impacts are far-reaching, affecting agriculture, health, infrastructure, and socio-economic stability. Projections indicate worsening conditions unless urgent mitigation and adaptation measures are implemented. Strengthening resilience through climate-smart agriculture, improved water management, and sustainable urban planning is critical to mitigating the impending threats posed by climate change.

Institutional context

Flood, drought and water management in the targeted countries is supported by national meteorological and hydrological services (NMHS), river basin organizations, international organizations, and community-led initiatives.

The national meteorological and hydrological services (NMHS) are the authoritative and main providers of weather, water, climate and related environmental services. NHMSs monitor hydro-climatic conditions, issue flood and drought warnings, and collaborate with regional and international partners to enhance services for risk preparedness and warning. Across all countries, National Meteorological Services (NMS) observe, understand and predict the weather and climate and provide services in support of users. National Hydrological Services (NHS) are responsible for monitoring water resources and providing services such as model-based forecasts for river water levels. In both countries, NMHS are two separate entities under different ministries and coordinating with other responsible agencies as shown under Table 5.

Table 5 National Agencies involved in water resources, flood and drought risk management in Ghana and Côte d'Ivoire

Country	*National Meteorological Services (NMSs)*	*National Hydrological Services (NHSs)*	*Other responsible agencies*
Ghana	Ghana Meteorological Agency (GMet)	Ghana Hydrological Authority (GHA)	National Disaster Management Organisation (NADMO), National Communications Authority (NCA), National Development Planning Commission (NDPC), Water Resources Commission (WRC)
Côte d'Ivoire	Société d'Exploitation et de Développement Aéroportuaire, Aéronautique et Météorologique (SODEXAM)	Directorate of Water Resources Management (DGRE)	The Ministry of Interior and Security of Côte d'Ivoire Ministry of Planning and Development

At the regional level, all the targeted countries are members of the Economic Community of West African States (ECOWAS). ECOWAS, the West African Economic and Monetary Union (UEMOA) and the Permanent Inter-State Committee on Drought Control in the Sahel (CILSS) set policies for the region and foster a stronger regional collab-oration on exchanging information and developing joint services. The ECOWAS Flood Risk Management Policy, adopted in 2021, promotes coordinated actions and investments in hydromet services, early warning systems, flood risk assessments, and data exchange.

Regional climate Centers as shown in Figure 8: The Regional Center for Training and Application in Agrometeorology and Operational Hydrology (AGRHYMET), functions as a Regional Climate Center for West Africa and the Sahel following a cooperation agreement signed in 2020[28] between ECOWAS and CILSS which also mandated AGRHYMET to provide services to all ECOWAS Member States. The Centre's main mission is to strengthen food security and increase agricultural production in member countries; it also contributes to improved natural resource management in the Sahel region, providing training and information to stakeholders and development partners in the field of agroecology in the broadest sense (agroclimatology, hydrology, crop protection). AGRHYMET is the region's leading authority on science and technology as applied to agriculture, rural development, and natural resource management. AGRHYMET and the African Centre of Meteorological Application for Development (ACMAD) as regional climate centers are responsible for performing, among other, long-range forecasting, regional tailored products and seasonal climate outlooks, climate monitoring, data services as well as training and capacity building. [29]

INSTITUTION	SPECIFIC SERVICES, PRODUCTS AND APPLICATIONS	DATA-SHARING PROTOCOL WITH MEMBER STATES IN PLACE AND OPERATIONAL	SUPPORT TO MEMBER STATES WITH OBSERVATION NETWORK	USERS AND TARGET AUDIENCE	TRAINING AND RESEARCH PROVIDED TO MEMBER STATES
ACMAD	Annual State of African Climate; 10-day, monthly climate dia. bulletins. Daily: (Severe) Weather forecast, flash flood risk forecast. Weekly: Niger basin rainfall forecast.	No data-sharing protocol.	No observation network support to member states.	International partners, NMHS. Contributes to PRESASS and PRESAGG.	Training in specific meteorology applications.
AGRHYMET	10-day, monthly, seasonal bulletins for rainfall, onset, dry spells. Satellite-derived products Monthly: agriculture, hydrological, plant health bulletins.	Data-sharing protocol with CILSS member states.	Backup database for member states but not frequently updated; guidance on network expansion database management CLIDATA and other software.	ECOWAS, international partners, Ministries of Agriculture and Food Security, NMHS. Contribution to PRESASS, PRESAGG.	Tailored research and advisory services; training program for agro-meteorology; training for operation and maintenance.

Figure 8: Activities supported by regional entities in the targeted countries

River basin organizations: By river catchment boundaries, river basin organizations play a critical role in promoting transboundary cooperation resources management among the riparian states. ECOWAS Member states look to river basin organizations to provide technical assistance for the collection, management and communication of hydrological data and to support flood and drought forecasting coordination on issues relevant for the respective basin. The Volta Basin Authority (VBA) is the key transboundary institution for integrated water resources management in the Volta Basin, which includes Benin, Burkina Faso, Côte d'Ivoire, Ghana, Mali, and Togo. The previous VFDM Program was implemented in collaboration with VBA and strengthens flood and drought management through improved data sharing, early warning systems, and local capacity-building. Additionally, within the targeted countries, the Niger Basin Authority (NBA) governs the Niger River Basin covering northeastern parts of Côte d'Ivoire.

Many challenges remain and limit the full potential of a closely integrated landscape of weather, climate, water, and early warning services. This includes (a) policies and data-sharing arrangements; (b) infrastructure, observation, data management and forecasting capacity; and (c) institutional issues, including sustainable financing of the institutions involved.

Table 6 Membership of countries to regional organizations.

Country	Policy		Regional Climate Centers		River Basin Organisations	
	ECOWAS	UEMOA	AGRHYMET	ACMCD	VBA	NBA

[28]UNDP 2021, AGRYHYMET Capacity Assessment. https://www.undp.org/sites/g/files/zskgke326/files/2023-03/EN_AGRHYMET%20Capacity%20Assessment%202022.pdf

[29] ECOWAS Hydromet Initiative, Strengthening Weather, Climate, and Water Services In West AfricaAnalytical Report, 2021 ECOWAS-Hydromet-Initiative.pdf

Côte d'Ivoire						
Ghana			*			

*As the Regional Climate Center for West Africa and the Sahel, AGRHYMET covers all ECOWAS member states.

Status of national meteorological and hydrological services (NMHSs)

WMO (2015) defines four service levels for the provision of service status of weather, climate and water services as: (a) basic, (b) essential, (c) advanced and (d) full. An evaluation of NMHS in the region in 2020[30] categorized the National Meteorological Services (NMS) of Ghana (Ghana Meteorological Agency) with advanced to full-service status. On the other hand, the National Hydrological Services (NHS), Ghana Hydrological Authority (GHA)) were found to be substantially weaker than the NMS in general with low staffing, low operational budgets and overall weak observation networks. In Côte d'Ivoire, SODEXAM provides **essential-level weather and climate services**, as per the World Meteorological Organization (WMO) standards. This includes the issuance of daily weather bulletins, severe weather-related advisories or warnings, 10-day agrometeorological bulletins, which offer summaries and charts crucial for agricultural planning. The hydrological services are currently at a basic level, indicating limited capacity in monitoring and managing water resources.

Status of hydro-meteorological observation networks

In West Africa, over 60 percent of data is collected manually by non-professional and voluntary staff. Consequently, it is of limited standardised quality and cannot be used for real-time monitoring and early warning. The radar network is scattered and often defunct. Many of the NMHS have outdated information and communications technology (ICT) infrastructure, whereas frequent power cuts and weak internet connection limit access to global data sets and operational capacity of NMHS. All ECOWAS member states reported challenges with adequate operation and maintenance of the systems. Hydrological and meteorological sensors need frequent calibration to ensure accurate data recording, which was reported as a challenge to calibrate instruments on a regular basis, due to the lack of capacity and the absence of a calibration unit for West Africa.

Within the Volta Basin, the hydrological and meteorological observation network as shown under Table 7 has significantly improved over the past decade, largely due to targeted interventions by national agencies, regional initiatives, and international support programs. The Volta Flood and Drought Management (VFDM) Project, implemented by the World Meteorological Organization (WMO) in partnership with the Volta Basin Authority (VBA) and the Global Water Partnership (GWP), has played a crucial role in strengthening hydrometeorological infrastructure, data collection, and early warning capabilities in the region. In the VFDM project, two Meteorological Stations and 5 Hydrological stations were installed in both Côte d'Ivoire and Ghana.

Table 7: Hydrological and Meteorological stations before and after the VFDM project of the implementing countries in the volta basin

Country	*N° of Synoptic stations*	*N° of agro-meteorological stations*	*N° of rain gauge stations*	*N° of hydrometric stations*	*Total*
Côte d'Ivoire	14 **14**	18 **19**	194 **194**	153 **155**	379
Ghana	8 ***44***	6 ***10***	40 ***103***	16 ***56***	70

Source: SODEXAM and GMet

Status of flood forecasting and early warning solutions

The VFDM project provided the first of its kind large scale early warning system (VOLTALARM) across the volta basin covering parts of Benin, Burkina Faso, cote d'Ivoire, Ghana, Mali and Togo (**Error! Reference source not found.**). VOLTALARM EWS is operationally used by the volta basin countries a nd regional authorities to monitor flood and drought, with warning bulletins (Figure 9) issued to stakeholders such as disaster management and other humanitarian organizations. Flood bulletins are issued twice a week, which provide a detailed outlook on precipitation and river water levels and potential impact on populations, crop land and built-up areas. For drought forecasts, bulletins are issued monthly with information on evapotranspiration, vegetation conditions and impact on crops. Additionally, the potential risks for population and on agriculture is also highlighted for each country particularly for the areas within the Volta basin.

Figure 9 VOLTALARM coverage in the Volta Basin - VFDM web-based Early Warning System

[30] ECOWAS Hydromet Initiative: Strengthening Weather, Climate and Water Services in West Africa. An Analytical Report.

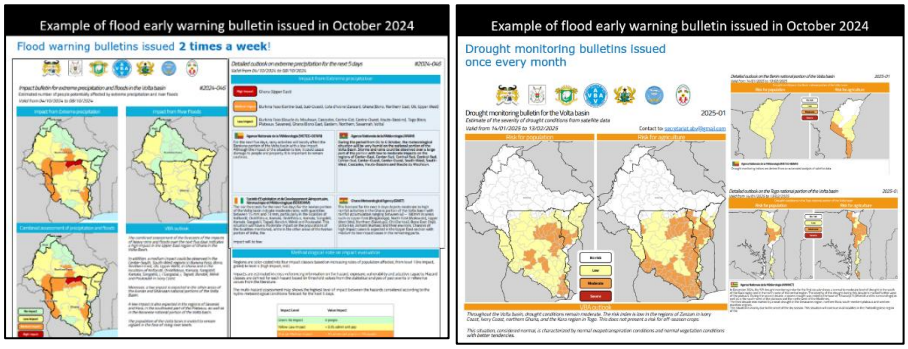


Figure 9 Flood early warning and drought monitoring bulletins issued through the VFDM early warning system

Critical gaps remain in delivery of meteorological and hydrological Services such as advisories for agriculture in terms sowing of seeds, harvesting of crops to avoid impacts due to sudden precipitations as well as sub-seasonal to season outlook for improving water resources management for the purpose of hydro-power generation, water utility, irrigation etc. In terms of last mile connectivity, coverage through early warning systems and increasing the involvement of women and vulnerable groups as users and beneficiaries are still required in the two countries mainly using the experiences from the VFDM project. Socio-economic analysis shows that benefits of early warnings to economic sectors like agriculture and energy production range between $515 million and $1.4 billion over the life of investment (two-thirds of total benefits). Efforts are made by the volta basin countries to develop early warnings systems for risk informed decision making and management.

Ghana - The Flood Early Warning System (FEWS-Volta) has been developed for the White Volta Basin (2011-2012) and for the Oti basin (2016-2018) with the support of the World bank and local Ghanaian and Togolese (for the Oti basin) governmental institutions are still operational and used by the GHA.

Côte d'Ivoire- benefits from NASA's Model of Models (MoM)[31], a groundbreaking global flood early warning technology. This system combines data from open-source hydrological models with Earth-observing satellite data to generate flood risk updates several times a day. The MoM is integrated into the Pacific Disaster Center's (PDC) DisasterAWARE platform, which sends flood early warning notifications to impacted communities. There is a flood early warning system developed for Abidjan city by global organizations due to the losses suffered by these cities over the years.

Impact based forecasting systems at a national scale are absent in both countries. Limitations in sub-seasonal to seasonal forecasting remain as global models are weak in capturing the African monsoon features, whereas the forecasting abilities become weak beyond three days and seasonal outlooks cannot be downscaled to the local level. The establishment of an integrated hydrological and meteorological forecasting system is essential for generating adequate products for warning systems. There are improvements required in developing early warning systems for flash floods and urban floods for which necessary infrastructures for timely data collection, models and tools for monitoring and forecasting and warning communication channels are needed for anticipatory actions. Capacity building efforts are further required for NMHSs (existing capacities are presented under Table 8) on short-, medium- and long-range forecasts and also for the development of specific end-user products.

Table 8: Status of capacities of National Hydrological Services (NHS), self-reported (as of December 2019).

COUNTRY INSTITUTIONAL SET-UP	STAFF *of which hydrologists*	Observation network (surface water)	Forecasting system	Services provide
Côte d'Ivoire	13 staff *2 hydrologists*	148 limnigraphs without telecommunication	Not available for the entire country except the Volta region	Hydrological data collection Riverine flood monitoring
Ghana	29 staff *7 hydrologists*	10 limnigraphs without telecommunication 166 limnimetric scales	Available for Oti and White Volta Impact-based forecasting available for the Volta area	Drought base flow Flood forecasting (Volta) Hydrological data collection Water resources assessment

Policies and data-sharing arrangements: Sharing real-time and historic hydrological and meteorological data across countries and basins can improve forecasts and can strengthen the accuracy of global and regional models and applications such as flood forecasting. Successful data-sharing mechanisms require adequate servers, transfer mechanisms, meta data and protocols. Within the ECOWAS region, a data-sharing agreement exists between AGRHYMET and its CILSS member states as well as within river basin organizations and the respective directorates of water resources. The ECOWAS Flood Risk Management Policy, adopted in 2021, provides a framework for exchanging information on flood risks and flood early warning in the region. Improved coordination among different national and regional institutions will enhance effective exchange of forecasting and early warning information.

Targeted project areas and beneficiaries

The recently completed Volta Flood and Drought Management (VFDM) project developed risk maps and highly vulnerable areas were identified. The VOLTALARM early warning system provided more time for communities to prepare and respond to risk. For instance, in Ghana the lead time increased from 24 hours to 48 hours. Recommendations were made by national agencies to extend the coverage of timely warnings beyond the volta basin to all populations in the Volta countries. This project will therefore be integrated in national institutional frameworks to enhance national capacity and ensure operational sustainability. This project will further follow the recommendation of the previous VFDM to strengthen community adaptation and provide sub-seasonal to seasonal forecasts of water flows over various timescales.

At community level, the project will promote risk awareness and implementation of adaptive strategies, as well as communication of early warning products to facilitate response and preparedness. More critical attention will be drawn to vulnerable or high-risk areas identified from the community-level risk maps to enhance dissemination, community engagement and adaptation for resilience and preparedness.

[31] NASA Partnership Launches Groundbreaking New Global Flood Early Warning Technology | NASA Applied Sciences

National entities will be integrated to contribute to the development of tools and improved services; and in turn the project will strengthen technical capacity for flood, drought and water risk management including capacity building on available tools, integrated risk assessment and forecasts.
At regional level, VFDM II will directly feed into the regional and global frameworks and initiatives for disaster risk management. The project will strengthen early warning and water availability assessment which are currently not yet served by the ECOWAS hydromet initiative which is currently strengthening hydrometeorological observation and data monitoring. More so, the initiative calls for incremental increase in capacity of national meteorological and hydrological services, through modernization of services and coordination with partners to promote investments such as in early warning systems and flood risk assessments. Strengthening hydrometeorological services in West Africa requires substantial investments and concerted support from governments, development partners and private sector. The ECOWAS hydromet initiative estimated investment needs of $324.5 million for which flood early warning systems were observed as very lacking in the region and yet the highest damage and loses were experienced from floods.

Phase 1: Under the proposed project in Côte d'Ivoire and Ghana, flood hazards are mostly reported either as pluvial flood linked to high rainfall precipitation or as riverine flood. The available flood risk maps for current and future predicted climates for the overall surface of Côte d'Ivoire and Ghana reflected increased possible pluvial floods and risk indicators on population, built-up areas, agriculture, water resources, wetlands and protected areas etc. Drought on the other hand can affect any part of the basin. Through risk maps, climate scenarios and HydroSOS EWS, the project will provide important support for a much larger population vulnerable to floods and drought and their impacts. The direct beneficiaries of the new tools within the two countries will include

1. National Meteorological and Hydrological Services (some 100 persons from the two countries), who will be contributing to the development of the tools, providing improved or new services but also gaining in capacities and means of actions.
2. Emergency, Civil protection authorities and Disaster Management Services (estimated 500 to 1000 persons from two countries), who will be integrating new risk maps/warning into their operating procedures and crisis management.
3. Other National authorities of the countries and related departments (estimated total 200 persons) such as Health, Water, Irrigation and Agriculture.
4. Social Institutions such as schools, hospitals, fire stations etc. (estimated to several thousands of people), who will be able to prepare or improve their emergency plans;
5. Non-governmental organizations (NGO's), International Non-governmental organizations (INGO's) (estimated to be several hundreds), who will either directly use the new information to improve their resilience capacity and adaptation or transfer to their partners.
6. Community-based organizations (CBO), farmer and fishermen associations, in particular women groups etc. (estimated to be thousands of persons over the basin) who will be using the new tools and methodologies to decrease their vulnerability to extreme events;
7. Managers of industrial sites (estimated to several thousands of people over the basin), and private companies (dam's operators) who will be able to draw emergency plans and build more resilient infrastructures;
8. Individual Community members of urban and rural areas especially youths who are more familiar with Information Technologies who will get timely warning messages and possibly contribute to disseminating and crowdsourcing of information for early actions.;
9. Universities and research institutions who will contribute to the scientific basis of tools and methodologies and help to convert results into education and research.

Phase 2: A series of pilot testing on the dissemination, use and feedback of the HydroSOS and impact-based flood and drought Early Warning System will be conducted during the monsoon and dry season for selected target areas as shown below in Table 9 (tentatively marked under Figure 11), which involve representatives of the major groups of beneficiaries. Eight pilot-test areas, expected to be studied during year 3 and 4 of the project have already been identified on the basis of following criteria (final selection will be performed during the course of the project):

- agricultural or urban areas on which collaborations are already established with communities and groups of citizens for example in the field of water resources management, land planning, risk reduction, exercises with civil security, any project related to the participation of citizens and communities.
- agricultural or urban areas that have been affected by extreme events (drought or flood).
- areas where Early Warning Systems have been set up (by previous projects) and are being used.
- areas preferably with mobile network coverage or with a good telecommunication system.
- areas where the effect of extreme events is known, or areas to be affected by dam operations.

Figure 10 The project targeted areas highlighted in Green and some of the potential locations (Blue for Floods and Orange for Drought) selected for the testing of the EWS during wet and dry seasons

Table 9: Pilot tests location for the flooding and dry season

Location of pilot sites (hazard type)	Estimation of the number of people participating to the pilot testing exercise	Criteria for selection
Abidjan and nearby Area (Floods)	50,000	The economic capital faces increasing vulnerability to coastal flooding, erosion, and landslides, especially during the rainy season. Rapid urbanization suffers from drainage problems and inadequate infrastructure exacerbate these risks.
Greater Accra (Floods)	50,000	Especially Accra city due to poor urban drainage and rapid urbanization.
Upper East and Upper West Regions (Floods and Drought)	30,000	Seasonal floods during the rainy season and dam spillage effects. Also, Semi-arid with frequent dry spells.

Ashanti Region (floods)	20,000	Particularly Kumasi and surrounding areas in Ghana are facing severe flooding events and impacting lives and livelihoods
Northern Regions of Côte d'Ivoire (Drought)	10,000	Deforestation has contributed to decreased rainfall patterns, leading to desertification and degradation of arable land, particularly in the northern parts of the country. Between August and November 2024, the Northern regions experienced severe droughts, adversely affecting staple crops like maize, millet, groundnut, and rice.
Greater Bassam (Coastal flooding)	50,000	This coastal area is at significant risk from sea-level rise, with projections indicating potential rises up to 1.2 meters, leading to increased flooding and associated socioeconomic impacts
Woroba District (Floods and Drought)	50,000	The Woroba District in northwestern Côte d'Ivoire faces significant risks from both droughts and floods, largely due to its geographical location and climatic variability. While specific recent data on drought or flood events in Woroba is limited, the region's climate patterns suggest vulnerability to these hazards.
Vallée du Bandama (central north) (Drought)	100,000	The Vallée du Bandama district in north-central Côte d'Ivoire has been experiencing agricultural drought conditions. According to the Global Drought Observatory (GDO), the region was classified under a "medium" drought impact level, indicating notable stress on agriculture and water resources.

The pilot testing will provide the opportunity to train communities and agencies during real flooding or drought situations which will help to assess the effectiveness and applicability of the HydroSOS and Impact based flood and drought EWS. The results of the exercises will provide lessons learned and will allow us to identify gaps and challenges to improve the system and services. The knowledge gained by the communities and agencies will be helpful to implement similar activities with other stakeholders. The pilot testing communities (100-150 at each site including women and youths) and agencies (10-20 at each site working in disaster management, civil protection, irrigation department, CBO's, NGO's) are expected to disseminate this knowledge and skills in other areas, inside or outside the basin, where floods and drought management are also of growing concerns.

Phase 3: Capacity development activities will be carried out for agencies at local/national and regional level for different services as shown under Table 10 and communities which are affected by floods and drought events during the different phase of the project on following areas:

- Extreme events, risks maps and climate change adaptations
- Flood and Drought Risk assessment and information on risk profile through a national/regional database.
- Floods and drought risk maps development at national and transboundary level.
- Information on future social and environmental risk scenarios and risk management strategies.
- Early Warning System for floods and drought and measures to reduce risk
- Multi Hazard End-to-End Early Warning System
- Mainstreaming Gender in Flood Management.
- Dissemination of early warnings to agencies, IOs, NGOs, communities and citizens.
- Natural and nature-based solutions for floods considering ecosystem sustainability.
- Identification of gaps and needs for the long-term strategies for floods and drought management and climate change adaptation by local and national stakeholders of Volta Basin countries.
- Revision, or development, of plans, policies and guidelines for risk reduction in the view of future climate change by national and regional policymakers.

Table 10 Key sectoral beneficiaries of the VFDM Phase 2 project and the hydrometeorological products and services required to strengthen preparedness, response, and resilience to floods and droughts.

BENEFICIARIES	WEATHER AND CLIMATE SENSITIVITY	BENEFITS OF HYDROMET PRODUCTS AND SERVICES	TYPE OF PRODUCTS AND SERVICES REQUIRED	GAPS LIKELY TO BE FILLED
Irrigated crop producers	Availability of surface and groundwater water resources for irrigation. Irrigation management depends highly on precipitation, evapotranspiration, and temperature forecasts	Water-efficient irrigation management based on accurate forecast of precipitation, ET and temperature and surface and groundwater availability; assets/ terms of trade, management of production and market risks.	Seasonal climate outlooks; hydrological forecasts (for flood prevention to avoid damage to infra-structure and pumps; surface and groundwater availability; hydrologic assessments and modeling to optimize irrigation; advisory services to water user associations	Farmer targeted forecasting; improved agrometeorological and hydrological products (surface and groundwater availability, hydrologic assessments and modeling); hydrological information; feedback mechanism for farmers; application of weband cell phone- based services; seasonal climate outlooks
Fishing (inland)	Dependency on water quality; fish stock impacted by droughts (low water levels, low oxygen) and floods (siltation)	Fishing operations and day-to-day management of stocks; water quality improvement.	Relevant information on water quality and levels; flood and low water level forecasting; siltation information.	Siltation monitoring; combined weather, climate and fishing extension service applications; water quality monitoring, and modeling
Hydropower	Water level and quality (sediments) and precipitation information are critical for a successful operation (water release, spilling, IDT curve).	Day-to-day operations maximizing hydropower output and optimizing water releases from reservoirs.	Water availability and water quality monitoring, modeling, assessments and forecast; precipitation and forecast and seasonal climate outlooks	Dedicated services for hydropower operators; direct linkage to services from NHS to hydropower operator
Extractive Industries	Small mine operations depend on ground water levels.	Improved day-today operations and environmental protection.	Mining-related information; ground water monitoring.	Industry-specific services; improved groundwater and environmental monitoring;
Urban Planning and Local Government	Population at risk of floods, droughts needs protection and relief provisions.	Timely evacuation of population; flood risk zoning and incorporation in spatial planning; long-term planning taking into account future climate risks.	Flood forecasting and early warning systems and community communication; long term trend on extreme events and future climate projections.	Flood forecasting and early warning systems development; end-to-end communication of early warning information; better climate projections and use in planning.
Civil Protection (and protection of livelihoods)	Extreme weather and climate events impacting communities and leading to increased uncertainties and need for civil protection.	Improved early warning information, with increased lead time.	Early warning information for rivers in rural and urban areas and short to medium- term forecasts for storm surge.	End-to-end early warning information and improved response capacity

Health	Extreme weather and climate events impacting communities and leading to new diseases.	Improved early warning information, with increased lead time.	Early warning information for rivers in rural and urban areas and short to medium-term forecasts for storm surge.	End-to-end early warning information and improved response capacity.

Project/Programme Objectives:

The main objective of the second phase of the Volta Flood and Drought Volta Management (VFDM) project is to enhance the climate adaptive capacities and resilience to hydro-climatic risks across the entire countries of the Volta Basin – Ghana and Côte d'Ivoire, reducing vulnerability of over 60 million people[32]. The project supports this objective through integrated and cross-cutting solutions that span technical, institutional, and governance dimensions. It will scale early warning systems at the national scale, provide updated climate risk information and projections, and promote localized adaptation strategies. These efforts aim to empower institutions and communities, while also strengthening social, economic, and environmental resilience to climate impacts. Consequently, the VFDM phase-2 project seeks to strengthen community preparedness and resilience to climate shocks and stresses through the development and diffusion of nature-based and locally driven innovative tools and solutions; enhance the economic resilience of vulnerable households and communities through diversified and sustainable livelihood opportunities; reinforce governance frameworks by supporting the development, revision, and adoption of policies, regulations, and standards that integrate resilience into climate change adaptation and disaster risk reduction at all levels. Together, these contribute to the Adaptation Fund's objective of enhancing adaptive capacity, promoting resilience, and reducing climate risk for vulnerable communities.

During the implementation of the first phase of VFDM, several recommendations were made which will be considered during the implementation of the second phase. Some of the recommendations include implementing the regional strategy for the reduction and integrated management of floods and drought risks with a 5-year implementation action plan, developing and updating risk maps and climate change projection, scaling the VOLTALARM EWS to cover the national scale, and community-based climate change adaptation and disaster risk management etc. were proposed for the two targeted countries of this project. Building on the lessons learned from the previous implementation of VFDM, the expanded project will encompass comprehensive national adaptation and disaster risk reduction strategies, implementing an integrated framework across the targeted countries structured in 3 thematic areas to:

i. Strengthen Multi-hazards (particularly floods and droughts) EWS and water resources monitoring (supported by Component 1, 2 and 3 related activities)

Establishing country-wide warning and information system to provide hydrometeorological products and services for flood and drought risk management to ensure access to early warnings to all populations in Ghana and Côte d'Ivoire. Additionally, the EWS will provide flow forecasts for sub-seasonal and seasonal outlooks on the availability of water resources to ensure long-term water monitoring for sustainable environmental, economic and social development. The VOLTALARM early warning system, developed during the VFDM project is a scalable and robust data and model integration platform based on state-of-the art cloud-based client-server architecture. It allows for the virtual integration of different forecasting solutions such as the existing national modelling systems in Ghana (FEWS Ghana), regional hydrological forecasting system introduced by the FANFAR project, operated by AGRHYMET based in Niger and global hydrological forecasting system such as GloFAS. Furthermore, the operational usefulness of additional global hydrological forecasting products and the blending of global, regional and local forecasting products will be explored. VOLTALARM enables the integration of observed hydrological and meteorological data in the Volta region and beyond. It therefore strongly contributes towards data sharing among riparian states and provides an opportunity for coordination of warning services, a crucial prerequisite for effective integrated water resource management. Effective EWS requires an enabling policy environment, comprehensive disaster risk knowledge, real-time observation, accurate impact-based forecasting, and efficient communication, all coordinated across multiple sectors and with local community involvement.

ii. Integrate community adaptation and nature-based solutions (supported by Component 1 and 2 related activities)

Develop and implement measures to safeguard the livelihoods of smallholder farmers and urban populations, with a strong focus on sustainable agriculture, improved land-use planning, and ecosystem restoration. While the VFDM project developed capacities on nature-based solutions for flood and drought management, there was a need for implementing identified natural and nature-based solutions effectively addressing both flood and drought risks at national and local levels in the Volta Basin countries.

This phase will seek to enhance nature-based solutions and expand coverage beyond the Volta Basin to other critical locations across the two countries. The project will improve community adaptation actions through flood risk awareness and access to information, services and tools for planning and response. The new phase of the project will prioritize early and continuous involvement of communities to ensure that interventions are tailored to local needs and context. This will ensure that local stakeholders and communities are actively involved in planning and response efforts, in alignment with national adaptation plans (NAPs) in Ghana (2023)[33].

iii. Strengthen Institutional capacity and coordination for resilient society (supported by Component 1, 2 and 3 related activities)

The project will strengthen national and transboundary governance frameworks including strengthening collaboration between hydrological, meteorological and disaster risk management entities and hence lead to more resilient and coordinated responses to climate-related hazards. Enhanced coordination among the two countries will facilitate the exchange of technical expertise and best practices for climate resilience, as recommended in the MPDSWM (Master Plan for Development and Sustainable Water Management) by the Volta Basin Authority. This will further include enhancing the technical and institutional capacities of the national services and collaboration with relevant stakeholders for the production and dissemination of relevant products and services. Beyond reinforcing regional institutional capacity, this collaborative platform will also support the ongoing implementation of the Sendai Framework for Disaster Risk Reduction (2015–2030) and help meet Sustainable Development Goals (SDGs) such as SDG 13 (Climate Action) and SDG 6 (Clean Water and Sanitation).

VFDM-Phase 2 project is aligned with the Adaptation Fund strategic objective to "reduce vulnerability and increase adaptive capacity of communities to respond to the impacts of climate change at local, national and regional level" aligning directly with the six main Adaptation Fund strategic outcomes of reduced exposure at national level to climate-related hazards and threats (Outcome 1), strengthened institutional capacity to reduce risks associated with climate-induced socioeconomic and environmental losses(Outcome 2), diversified and strengthened livelihoods and sources of income for vulnerable people in targeted areas (Outcome 6), strengthened awareness and ownership of adaptation and climate risk reduction processes at local level (Outcome 3), Improved policies and regulations that promote and enforce resilience measures (Outcome 7) and Support the development and diffusion of innovative adaptation practices, tools and technologies (Outcome 8). The VFDM-Phase 2 project will support the United Nations Early Warning for All initiative (EW4All) which is led by the WMO and other international partners to ensure everyone on the planet is covered by early warning systems in the next five years. Also, Ghana is supported through Systematic Observation Financing Facility (SOFF) initiative (UN Fund co-created by UNDP, UNEP and WMO) and Adaptation Fund is a member of the SOFF Advisory Board). SOFF's goal is to support countries to improve their

[32] Combined population of Côte d'Ivoire and Ghana as of 2023, https://data.worldbank.org/indicator

[33] Ministry of Environment, Ghana. (2023). *National Adaptation Plan Update 2023*. Accra: Government of Ghana.

meteorological observations in compliance with the internationally agreed WMO Global Basic Observation Network (GBON), and which in turn will support Global Research Centers for Long-Range Forecasts (such as the European Centre for Medium-Range Weather Forecasts) in developing high quality meteorological and hydrological monitoring and forecasting products.

Additionally, the project goals align with WMO's strategic plan for 2023-2027 and the Sendai framework for DRR 2015-2030 and contributes directly to Goal 13, as well as Goal 5, 6, 11 and 15 of the 17 Sustainable Development Goals (SDGs) adopted by the United Nations Assembly in 2015. Project activities will build on existing data from the VOLTALARM platform, mapping data of the vulnerability of communities to floods and droughts risks on sixty (60) pilot sites, and make use of the outcomes of other completed and on-going projects in the region as well as make use of technical capabilities of existing WMO programmes and initiatives such as the WMO Flood Forecasting Initiative (FFI), the WMO Integrated Processing and Prediction System (WIPPS), Global Hydrometry Support Facility (WMO HydroHub), the Global Hydrological Status and Outlook System (HydroSOS), WMO Hydrological Observing System (WHOS), WMO Integrated Global Observing System (WIGOS), WMO Information System (WIS), Climate Risk and Early Warning Systems (CREWS), as well as the project Assessment of Natural Disasters Impacts in Agriculture (ANADIA), to offer a more tailored, robust, innovative and sustainable solutions for water monitoring, disaster risk reduction and climate change adaptation in the two targeted countries.
This project plans to support integrated climate adaptation and management approaches to deal with increasing exposure to water-related risks. A change of systems and mindset will be carried out by bringing together different disciplines in the water, climate, and disaster management sectors and fostering collaboration amongst global, national, and local partners which traditionally have been working separately. This will be done by breaking institutional barriers among sectors and organizations and establishing a model of cooperation that will enable different actors to achieve common goals.

The broader aim is to forge new relationships that will deliver strategic results in the future, and beyond this project. A more detailed theory of change

(ToC) framework is provided below in Figure 12.

Current Situation: Hydro-climatic variabilities in West Africa pose significant risks on livelihoods and economic resilience through impacts on agriculture and critical infrastructure demonstrated by significant loss against GDP estimates. These vulnerabilities are heightened by the relatively limited adaptive capacity in comparison to the extent of risk, due to financial, technological and infrastructural constraints.
The VOLTALARM EWS that was implemented through the concluded VFDM project provided crucial early warning and risk information on water level, drought and flood risk information in the Volta basin, which improved response and preparedness to adapt with hydroclimatic variabilities. However, climate vulnerabilities are still prevalent, and more effort is needed to strengthen national capacities for risk warning and adaptation across different time scales and extend these vital EWS to cover other parts of the countries that are not within the Volta Basin.

Future Prediction: Increase in climate-based events such as floods and droughts can increase the vulnerability and related socioeconomic and environmental risks.

Existing issues and needs:
- Limited preparedness, adaptive measures and response of communities to flood and drought risk
- Limited hydrometeorological services for short- and long-term adaptation to hydrological hazards and resources planning
- Limited integrated service delivery at national and transboundary levels coupled with limited financing, technical capacity and coordination within the existing institutional frameworks.
-

Support from Component 1
-Enhanced understanding of hydroclimatic risks for risk-based informed decision making and preparedness
-Community-based flood and drought management including NBSs and gender mainstreaming for developing preparedness and resilience to climate change.

Support from Component 2
- Enhancement of flood and drought monitoring and forecasting capabilities and water resources planning, and coordination at national and regional scales.
- Integration of various forecasting tools for early warning services and short- and long-term flow projections to facilitate water resources management and planning and capacity development around these tools.

Support from Component 3
- Integration of EWS and tools within the existing policies, plans and institutional frameworks at national and regional
- Benchmarking across national capacities and coordination of regional climate adaptation efforts and decision-support frameworks and recommendations to ensure long-term resilience to hydroclimatic shocks.

Outcomes from Component 1
Outcome 1.1 - Improved knowledge of risks, climate change impacts and risk-informed decision making at the local, national and regional levels.
Outcome 1.2 - Preparedness and resilience to climate change promoted through community based and nature-based initiatives.

Outcomes from Component 2
Outcome 2.1- Established national inventories of hydro-meteorological data and information for developing tools and products to provide hydrological and meteorological services including water resources management.
Outcome 2.2 - Integrated Multi Hazard Early Warning Systems (EWS) and web-based Hydrological Status and Outlook System is designed and integrated together with the national hydrometeorological agencies and regional centers
Outcome 2.3: Strengthened technical capacity and coordination at national and regional level to improve early warning and facilitate response actions to safeguard populations and economic activities.

Outcomes from Component 3
Outcome 3.1 - Improved information base and practices to facilitate implementation of evidence-based strategies for improving policies, plans and actions plans (INDC, NAP and NAPA) with local collaboration.
Outcome 3.2 - Strengthened capacities of policy makers and decision makers at national and transboundary level on long term risk management policies, plans and strategies.

Outputs from Component 1
Output 1.1.1 Vulnerability and exposure assessment (including gender and sector-wise analyses) are conducted, and national risk maps are developed for the entire targeted countries.
Output 1.1.2 Enhanced capacity and awareness developed at local, national and regional levels (more than 1000 participants directly) to ensure risk informed decision-making.
Output 1.2.1 Community-based flood and drought management strategies and nature-based solutions for ecosystems restoration, water and land management implemented in more than 20 vulnerable sites. and
Output 1.2.2 Improved capacities on gender mainstreaming through outreach programs and relevant stakeholders (directly for more than 1000 participants) involved in disaster risk management.

Outputs from Component 2
Output 2.1.1 National Capacities, needs and existing resources for web-based EWS are defined and information needs for user-centred decision making identified.
Output 2.1.2: Enhanced national hydrological monitoring and data exchange (from more than 300 stations) and management system is established.
Output 2.2.1 The integrated MHEWS VOLTALARM Early Warning System is scaled and strengthened at national and regional levels to incorporate existing models, tools and data in one platform and warning services are provided for 60 million population.
Output 2.2.2 National and regional hydrological status, forecasting and outlook capacities for EWS are designed and developed through data standardization and availability from 300 hydro-meteorological stations and
Output 2.2.3 Existing products and tools (at least 10) are integrated and visualized in the regional HydroSOS for EWS and integrated within existing national and regional frameworks and initiatives to facilitate planning and risk-preparedness.
Output 2.3.1 Developed institutional capacity and awareness at local, national and regional levels (directly to more than 10000 participants) for enhanced impact based early warning services and decision-making.
Output 2.3.2 Promote coordinated and accessible national and regional decision tools for integrated climate and water risk adaptation and the developed tools disseminated to practitioners and decision makers.

Outputs from Component 3
Output 3.1.1 Best practices and experience from targeted regions and river basins are incorporated to ensure that existing national policies and practices (more than 10) are interoperable in regional cooperation framework
Output 3.1.2: Analysis and quantification of socio-economic benefits through national risk reduction strategy on floods and drought based on local collaboration.
Outputs 3.2.1 Specific actions prioritized by the relevant institutions towards risk-preparedness and resilience with national and international investments from government and private entities
Outputs 3.2.2 National and regional risk management strategies in short, medium and long-term integrated into development plans (economic, social, environmental aspects)

Overall Results
Agencies and communities have from component 1:
Improved risk knowledge, management, response and preparedness towards floods and drought at national and local levels

Overall Results
Agencies and communities have from component 2:
Access to flood and drought risk information and forecasts at various timescales for warning/advisory services

Overall Results
Agencies and communities have from component 3:
Coordinated evidence-based policies and plans on CCA and DRM through local collaboration for long term investment and sustainability

Future outcomes from the proposed project
Strengthened capacity and coordination of adaption and resilience capacities at all scales (community, national and regional) and reduced vulnerability of society to climate change impacts

Figure 11 Theory of Change of the VFDM-Phase 2 Project

Project/Programme Components and Financing:

Currently, the institutional arrangements for managing the water resources of the transboundary and national rivers of the Volta basin are lacking or not enforced. This will change with effective synergy and coordination between the Volta Basin Authority and the regional, national and other basin institutions. The separate approach of the respective countries leads to non-integrated management of water resources increasing the risk of water scarcity, land and natural ecosystem degradation.

For the two targeted countries, flood forecasting and early warning systems have until now been developed only for the Volta Basin region (national portion coming under the Volta Basin), White Volta (Ghana) and Oti (Togo and Ghana) sub-basins through the World Bank supported projects. A large part of the whole country therefore still needs some type of impact-based forecasting and warning procedure to organize actions between the technical institutions in charge of assessing extreme hazards, the National Meteorological and Hydrological Services (NMHS), the institutions in charge of disaster civil security and the communities and citizens at risk. This means therefore that the technical capacities to develop and run the models must also be developed, on the basis of the existing VOLTALARM experience. Depending on the responsibilities and capacities of the Meteorological Service/Agency and the Hydrological Service in the two countries, the development and maintenance of the forecasting tools could be assigned at the national level and coordinated at the regional level by the Volta Basin Authority. Coordination and communication within the agencies and communities on issues of floods and drought must be improved by developing the appropriate information services, radio programmes, websites and mobile platforms. Furthermore, communities should trust and follow the official messages from their national or regional centres. As the most effective way of communication is through mobile platforms, national institutions should explore the use of multiple channels of communication.

Several aspects must be defined and implemented in order to foster appreciable level of participation from communities and citizens into flood, drought and environmental management. Besides Legal Instruments and operational procedures to support integrated water resources management in the Volta Basin countries, additional non-structural measures, such as development of risk maps, education and awareness through capacity building, next to natural and nature-based solutions for flood and drought management should be implemented with the involvement of the stakeholders to increase climate resilience of the population. The VFDM Phase-2 components, outcomes and outputs and associated budget is provided under Table 11.

Table 11: VFDM Phase-2 components, outcomes and outputs and associated budget.

Project/Programme Components	Expected outcomes	Expected outputs	Countries	Amount (US$)
Component 1: Enhanced understanding and access to data and information for informed-decision making, risk-based preparedness and adaptation to hydroclimatic variabilities.	**Outcome 1.1**: Improved knowledge of risks, climate change impacts and risk-informed decision making at the local, national and regional levels	**Output 1.1.1** Vulnerability and exposure assessment (including gender and sector-wise analyses) are conducted, and national risk maps are developed for the entire targeted countries.	Côte d'Ivoire and Ghana	2,000,000
		Output 1.1.2 Enhanced capacity and awareness developed at local, national and regional levels (more than 1000 participants directly) to ensure risk informed decision-making.		
	Outcome 1.2 Preparedness and resilience to climate change promoted through innovative and community-based and nature-based initiatives	**Output 1.2.1** Community-based flood and drought management strategies and nature-based solutions for ecosystems restoration, water and land management implemented in more than 20 vulnerable sites.	Côte d'Ivoire and Ghana	2,000,000
		Output 1.2.2 Improved capacities on gender mainstreaming through outreach programs and relevant stakeholders (directly for more than 1000 participants) involved in disaster risk management.		
Component 2. Strengthening water resources management through access to hydro-meteorological information and augment regional /national capacity to monitor and assess Hydro-climatic hazards	**Outcome 2.1** Established national inventories of hydro-meteorological data and information for developing tools and products to provide hydrological and meteorological services including water resources management.	**Output 2.1.1**: National Capacities, needs and existing resources for web-based EWS are defined and information needs for user-centred decision making identified.	Côte d'Ivoire and Ghana	2,500,000
		Output 2.1.2. Enhanced national hydrological monitoring and data exchange (from more than 300 stations) and management system is established.		
	Outcome 2.2 Integrated Multi Hazard Early Warning Systems (EWS) and web-based Hydrological Status and Outlook System is designed and integrated together with the national hydrometeorological agencies and regional centers	**Output 2.2.1:** The integrated MHEWS VOLTALARM Early Warning System is scaled and strengthened at national and regional levels to incorporate existing models, tools and data in one platform and warning services are provided for 60 million population.	Côte d'Ivoire and Ghana	5,000,000
		Output 2.2.2 National and regional hydrological status, forecasting and outlook capacities for EWS are designed and developed through data standardization and availability from 300 hydro-meteorological stations		

		Output 2.2.3 Existing products and tools (at least 10) are integrated and visualized in the regional HydroSOS for EWS and integrated within existing national and regional frameworks and initiatives to facilitate planning and risk-preparedness.		
	Outcome 2.3: Strengthened technical capacity and coordination at national and regional level to improve early warning and facilitate response actions to safeguard populations and economic activities	**Output 2.3.1** Developed institutional capacity and awareness at local, national and regional levels (directly to more than 10000 participants) for enhanced impact based early warning services and decision-making.	Côte d'Ivoire and Ghana	3,000,000
		Output 2.3.2 Promote coordinated and accessible national and regional decision tools for integrated climate and water risk adaptation and the developed tools disseminated to practitioners and decision makers.		
Component 3: Promote accessible national and regional decision support tools and coordination to enhance resilient and sustainable climate risk adaptation through long term investments from policies, plans and actions plans (INDC, NAP and NAPA)	**Outcome 3.1** Improved information base and practices to facilitate implementation of evidence-based strategies for improving policies, plans and actions plans (INDC, NAP and NAPA) with local collaboration	**Output 3.1.1** Best practices and experience from targeted regions and river basins are incorporated to ensure that existing national policies and practices (more than 10) are interoperable in regional cooperation framework	Côte d'Ivoire and Ghana	750,000
		Output 3.1.2 Analysis and quantification of socio-economic benefits through national risk reduction strategy on floods and drought based on local collaboration.		
	Outcome 3.2 Strengthened capacities of policy makers and decision makers at national and transboundary level on long term risk management policies, plans and strategies.	**Output 3.2.1** Specific actions prioritized by the relevant institutions towards risk-preparedness and resilience with national and international investments from government and private entities.	Côte d'Ivoire and Ghana	750,000
		Output 3.2.2: National and regional risk management strategies in short, medium and long-term integrated into development plans (economic, social, environmental aspects)		
Project/Programme Execution cost				1,600,000
Total Project/Programme Cost				17,600,000
Project/Programme Cycle Management Fee charged by the Implementing Entity				1,760,000
Amount of Financing Requested				**19,360,000**

Projected Calendar:
Project duration: 5 years (60 months) as shown below under Table 12.

Table 12: VFDM Phase-2 project calendar

Milestones	Expected Dates
Start of Project/Programme Implementation	June 2026
Mid-term Review (if planned)	December 2028
Project/Programme Closing	June 2031
Terminal Evaluation	December 2031

PART II: PROJECT / PROGRAMME JUSTIFICATION

A. Describe the project/programme components, particularly focusing on the concrete adaptation activities, how these activities would contribute to climate resilience, and added value through the regional approach, compared to implementing similar activities in each country individually.

The territorial areas of the VFDM phase-I (already implemented) and those in the project proposed here are different as shown under Figure 15 and Table 20 under Part II. K. The first phase of the VFDM project supported only the areas of Ghana and Côte d'Ivoire that are within the Volta Basin region (approximately 42% of Ghana and 3% of Côte d'Ivoire respectively lies under Volta Basin region); the present project will cover entire territorial areas of these two countries through updating of existing as well as new developed products and tools for climate change adaptation and building resilience).

In the first VFDM phase, the focus was mainly on the monitoring, forecasting and management of the Transboundary flood and drought events in the Volta Basin region as these were the gaps and needs identified in the initial assessment studies carried out between 2014 and 2016.

However, over all the last one decade, there has been several flash, urban (major urban cities such as Accra in Ghana and Abidjan in Cote d'Ivoire are outside of the Volta region) and riverine (tributaries to Volta lakes etc.) floods and meteorological (lack of rainfall) and hydrological (hydrological (lack of rainfall leading to low river flows) droughts at the national levels (national portion of the countries outside of the Volta Basin region) which requires support in strengthening their existing EWS and improving the climate change adaptation at the community level improving their resilience for better socio-economic developments.

The 3 components of the proposed project targets 3 thematic areas identified by the partner countries in their recent needs assessment: 1) risk informed decision making for climate adaptation and resilience from local to national levels due to hydroclimatic variabilities, 2) development of integrated risk reduction and adaptation measures through EWS, 3) policy coordination and community capacity building at national and local levels. Implementing these at the national and regional scale will facilitate resources optimisation by utilising existing frameworks and capacities for climate resilience, while leveraging shared knowledge and contextual strategies through benchmarking practices across the project countries.

Component 1: - Enhanced understanding and access to data and information for informed-decision making, risk-based preparedness and adaptation to hydroclimatic variabilities.

Integrated management of hydroclimatic risks will enhance socio-economic productivity, reduce losses, damage and vulnerability through improved early response and preparedness to extreme hazards and variabilities in water resources. With population growth, limited resources, climate threats and the difficulties related to extreme events of floods and drought are foreseen to intensify and strengthening communities to be aware of these risks and build social cohesion that is necessary to be more responsive and adaptative. Activities of the Component 1 are meant to identify and assess the current and future vulnerabilities, capacities, exposures and risks (VCERs) at community level Floods and drought risk maps will be developed at local, national and regional levels. Climate scenarios will be gathered and disseminated to the stakeholders, together with risk's maps, to study the possible impact of climate change on the current VCERs to not only prepare for present but also for future. Bottom-up approaches of community participatory action such as for land management and ecosystems integrity will be implemented and further adaptive community approaches will be identified and strengthened. This will provide opportunities to identify adaptation gaps and draw recommendations for integrating climate change adaptation approaches into the current disaster risk management strategies. Adaptation measures and strategies will be discussed at local level in agreement with local organizations and communities to increase the resilience to floods and drought. The participation and engagement of local stakeholders will facilitate the adoption of the strategies and subsequently result in long-term sustainability

Component 2: Strengthening water resources management through access to hydro-meteorological information and augment regional /national capacity to monitor and assess Hydro-climatic hazards

Floods and drought have been identified by the Volta Basin countries as priority areas for transboundary management, together with other factors related to the degradation of ecosystems, such as soil degradation and deforestation[34]. Limited capacities and infrastructures results in water resources availability for food and energy security, and other key economic activities. The proposed VFDM phase 2 regional project will provide the basis for an integrated water information tool including flood and drought management[35] in the region, thanks to the data systems, collaboration between stakeholders with mandates and responsibility at all levels.

Component 3: Promote accessible national and regional decision support tools and coordination to enhance resilient and sustainable climate risk adaptation through long term investments from policies, plans and actions plans (INDC, NAP and NAPA)

Through this component, the project will seek to strengthen existing transboundary and national levels decision framework and strategies to overcome the challenges of the basin-wide water resources management. To increase adaptive capacity and empower people to cope with their changing environment, the development of decision-support framework can help national and local agencies to mutually understand and respond to challenges and opportunities and share knowledge in the Volta Basin countries.

The proposed project builds on a number of risk reduction master plans, such as the Volta Basin Strategic Action Programme, development strategies and adaptation measures listed in the Second edition of the Disaster risk management Program published by the Global Facility for Disaster Reduction and Recovery (GFDRR) of the World Bank in 2009. Volta Basin countries are identified as major priorities due to their high vulnerability to natural hazards and low resilience to climate change. Even though considerable funding has already been (or is being) attributed to the countries, a large coordination effort, joint methodologies and shared tools are still needed to ensure that the results and outputs of the national projects are integrated at transboundary level. A review of the existing policies, plans and guidelines (INDC, NAP and NAPA) will be carried out and necessary update based on the experiences gained from the implementation of proposed projects and other on-going or completed project will lead to enhanced resilient and sustainable climate risk adaptation through long term investments from governments or international financing mechanism. The VFDM phase-2 components, outcomes, outputs and budget is provided under Table 13 and linkages between them is demonstrated under Figure 13.

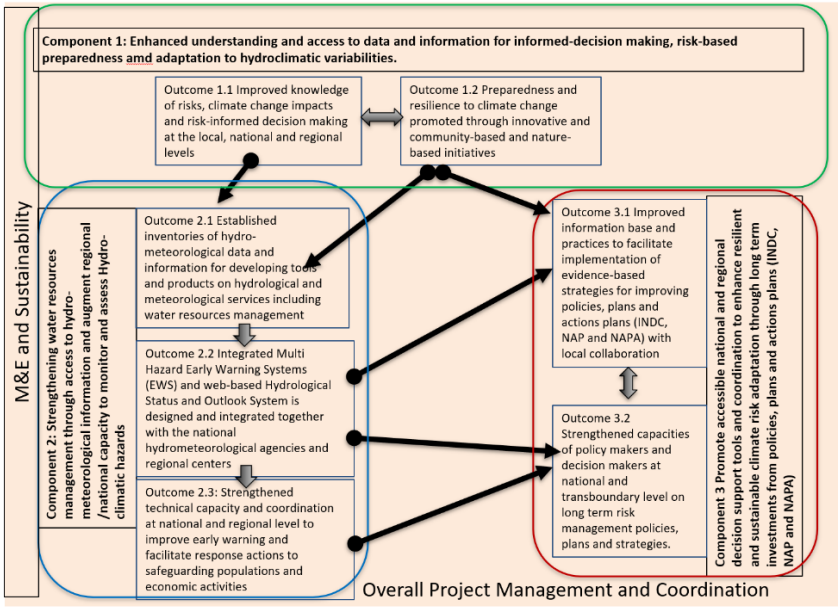


Figure 12 Linkages between the components and outcomes of the proposed VFDM phase-2 project

[34] (2016): Evaluation des besoins de renforcement des capacités. Préparation des projets de gestion intégrée des inondations pour le Bénin, Burkina Faso, Côte d'Ivoire, Ghana, Mali et Togo et le bassin de la Volta en Afrique de l'Ouest. Series of seven reports GWP West Africa. Unpublished

[35] the term "integrated management" refers to the consideration of all aspects of both hazard management from the technical studies, i.e. engineering, hydrometeorological and agronomic solutions, to the socio-economic, environmental and institutional implications that floods and drought entail, as explained in literature produced within the GWP-WMO associated programmes on Flood and Drought Management http://www.floodmanagement.info/publications/concept_paper_e.pdf and http://www.idmp.info/documents/IDMP_Concept_Note.pdf)

Table 13: VFDM Phase-2 components, outcomes and outputs and associated activities

Project Components	Expected outcomes	Expected concrete outputs	Activities Planned and agreed jointly with the NMHSs and other partners
Component 1: Enhanced understanding and access to data and information for informed-decision making, risk-based preparedness and adaptation to hydroclimatic variabilities.	**Outcome 1.1:** Improved knowledge of risks, climate change impacts and risk-informed decision making at the local, national and regional levels	**Output 1.1.1** Vulnerability and exposure assessment (including gender and sector-wise analyses) are conducted, and national risk maps are developed for the entire targeted countries.	Activity 1.1.1.1 Conduct a desk study (compilation of existing evidence-based past data (topographic maps, satellite images, studies of extreme events, reports of disasters, etc.) and field visits (approximately 60 communities) to gather available information on vulnerability and exposure for current and future climate and identify gaps or additional needs. Activity 1.1.1.2 Organize stakeholder's meetings and workshops with stakeholder groups working on risk management to select priority areas for community consultations, and stakeholder perspectives and needs for improved decision making. Activity 1.1.1.3 Conduct pilot field studies (focus group discussion and semi-structured interviews) with communities to identify the multi-dimensional drivers of vulnerability and risk (social, economic, ecological, cultural, political, and infrastructural determinants of vulnerability) in areas thar are highly exposed to different hydrometeorological hazards Activity 1.1.1.4 Develop web-based flood and drought risk maps using the dynamic hydrometeorological, environmental and static social and structural database and existing maps developed in the basin targeted countries through the previous Volta basin Flood and drought management project and other national projects (see part G for more information) Activity 1.1.1.5 Scenarios for socio-economic and environment development along with the climate change projections are collected and projected impacts on population, water resources, urban development, environment and agricultural areas are analyzed. Activity 1.1.1.6 Draft the field studies reports, country profiles and regional atlas with the existing static information available
		Output 1.1.2 Enhanced capacity and awareness developed at local, national and regional levels (more than 1000 participants directly) to ensure risk informed decision-making.	Activity 1.1.2.1 Collect experiences at local level on risk knowledge and coping strategies for floods and drought management and gather community needs for better decision-making Activity 1.1.2.2 Develop capacities of professionals, policy makers, decision makers on flood and drought management strategies for enhanced risk informed decision making Activity 1.1.2.3 Gather inputs and recommendations from various stakeholders and develop an action plan for disseminating it to the wider audiences
	Outcome 1.2: Preparedness and resilience to climate change promoted through innovative and community-based and nature-based initiatives	**Output 1.2.1** Community-based flood and drought management strategies and nature-based solutions for ecosystems restoration, water and land management implemented in more than 20 vulnerable sites.	Activity 1.2.1.1 Organize dedicated short courses on the IUCN standards for nature-based solutions approaches and concepts for targeted beneficiaries to disseminate knowledge on natural and nature-based solutions (NbS) for flood and drought management Activity 1.2.1.2 Recommend actions to increase the use of natural and nature-based solutions and environmentally friendly methodologies with the involvement of local population and aligning with the Adaptation Fund ESP principles Activity 1.2.1.3 Implement community-based flood and drought management (CBFDM) (based on the CBFDM manual developed under VFDM project) to enhance self help capabilities of vulnerable and marginalized communities from the pilot test locations Activity 1.2.1.4 Update community-based flood and drought management manual including safety and safeguard measures for preservation of natural habitats, land and soil conservation, biological diversity. Activity 1.2.1.5 Strengthen and scale up the local adaptive measures as identified with the communities under activity 1.2.1.3 Activity 1.2.1.6 Benchmark and share knowledge and experience of added value of local adaptive measures under 1.2.1.5 Activity 1.2.1.6 Collect feedback, suggestions and recommendations action plans at local and national levels for policy integration to strengthen community adaptation and resilience Activity 1.2.2.7 Conduct workshops to provide support for developing project proposals (submission to the internal and external agencies in future) on implementing natural and nature-based solutions for the flood and drought events.

Project Components	Expected outcomes	Expected concrete outputs	Activities Planned and agreed jointly with the NMHSs and other partners
		Output 1.2. Improved capacities on gender mainstreaming through outreach programs and relevant stakeholders (directly for more than 1000 participants) involved in disaster risk management.	Activity 1.2.2.1 Organize and conduct workshops on the Training Manual for mainstreaming gender in the End-End Early Warning System for Flood Forecasting (E2E-EWS-FF) and flood management with potential participants from NMHSs, local policymakers, civil authorities, women and community-based organizations etc. Activity 1.2.2.2 Collect recommendations and develop recommend actions that would improve the participation of women and other vulnerable groups into flood management and early warnings Activity 1.2.2.3 Develop documentation for raising public awareness (infographics, videos, mobile phone applications, educational tools for children and students, etc.) on CBFDM and gender mainstreaming activities.
Component 2: Strengthening water resources management through access to hydro-meteorological information and augment regional /national capacity to monitor and assess Hydro-climatic hazards	**Outcome 2.1:** Established national inventories of hydro-meteorological data and information for developing tools and products on hydrological and meteorological services including water resources management	**Output 2.1.1:** National Capacities, needs and existing resources for web-based EWS are defined and information needs for user-centred decision making identified.	Activity 2.1.1.1 Assess national technical capacities and capabilities including tools, value chains and relevant institutional set ups for delivering early warnings and water risk information in the target countries and regionally Activity 2.1.1.2 Decision-makers information needs are assessed and integrated for user-centred information on key water resources management parameters for current status and sub-seasonal and seasonal outlooks Activity 2.1.1.3 Assess the available IT equipment (computers, servers, databases, etc.) and IT/GIS expertise at the VBA observatory, the NMHSs services and other relevant services (e.g. Geographical Institute, Civil security, etc.). Purchase additional equipment if necessary Activity 2.1.1.4 Create the information exchange IT network by connecting the different platforms and tools including from the VBA observatory and the national services Activity 2.1.1.5 Define the needs related to facilities (rooms for developers, operational shifts, crisis communication, air conditioning, etc.), equipment (hard and software, including real-time connections), technical capacities, human resources (for daily activities and with additional resources during crisis) Activity 2.1.1.6 Perform a field/desk study to check the availability and quality of the data, and information related to runoff, rainfall and other relevant hydrometeorological and agrometeorological data and also through the flood forecasting and drought monitoring products available at each NMHSs and other relevant institutions. Activity 2.1.1.7 Analyse hydrological networks and make an inventory of the gauging stations with real-time data transfer (or pseudo real-time) in the targeted countries and prepare descriptive sheets for each station (location, equipment, data series, etc.) Activity 2.1.1.8 Organize training for the NMHSs staff related to data collection, calibration and maintenance of equipment following WMO standards. Activity 2.1.1.9 The historical and real-time hydrological data from the gauging stations are collected and the procedure to link with the meteorological data is defined
		Output 2.1.2. Enhanced national hydrological monitoring and data exchange (from more than 300 stations) and management system is established.	Activity 2.1.2.1 Enhance the Meteorological, Climatological and Hydrological (MCH) database including the main driving hydro-meteorological parameters for floods and drought events (e.g. precipitation, water levels, temperature, soil moisture, soil type, etc.) and create the links with the existing databases for the collected information on VCER along with the implementation of WMO information system (WIS) for data and information exchange. Activity 2.1.2.2 Rehabilitate or newly install hydro-meteorological stations to collect real time hydro-meteorological parameters, and interconnect with existing databases and platforms at national, regional and global scale Activity 2.1.2.3 For areas covered with hydrological and hydraulic models (Volta part for example), update or improve the floods (riverine, urban, flash floods, coastal, etc.) and drought (hydrological, meteorological and agri-meteorological) monitoring, and impact-based forecasting with available VCERs and risk maps Activity 2.1.2.4 For areas not covered with numerical models, identify needs and develop an operational flood (riverine, urban, flash floods etc.) and drought (hydrological, meteorological and agri-meteorological) products for use by the NMHSs
	Outcome 2.2 Integrated Multi Hazard Early Warning Systems (MHEWS) and web-based Hydrological Status and Outlook System is designed and integrated together with the national hydrometeorological	**Output 2.2.1:** The integrated MHEWS VOLTALARM Early Warning System is scaled and strengthened at national and regional levels to incorporate existing models, tools and data in one platform and	Activity 2.2.1.1: The web-based Multi Hazard Early Warning dissemination interface for VOLTALARM is updated with new information from the national databases and other projects or initiatives Activity 2.2.1.2 Buy, install and test the equipment needed to improve or update VOLTALARM EWS Activity 2.2.1.3 Develop capacity of the operational team in charge of VOLTALARM at the national services and at VBA (hydro-meteorological forecasters, IT specialists, communication officers, on-call teams, etc.) in continuous monitoring of the Web-based EWS Activity 2.2.1.4 Update the operational manual including procedures and responsibilities Activity 2.2.1.5 Run and maintain the VOLTALARM system

Project Components	Expected outcomes	Expected concrete outputs	Activities Planned and agreed jointly with the NMHSs and other partners
	agencies and regional centers	warning services are provided for 60 million population.	Activity 2.2.1.6 Organize consultations with the end-users from national and regional agencies and from communities to gather their expectations related to their future use of the prototype proposed on Figure 10 (background maps, zooms, types of graphs, location of evacuation centre, hospital, emergency centre, first-aid, etc.) Activity 2.2.1.7 Develop and test the web-based dissemination interface Activity 2.2.1.8 Write the user guide to convey all available knowledge on the interface to the various groups of users (forecasters, IT staff, decision-makers, etc.)
		Output 2.2.2 National and regional hydrological status, forecasting and outlook capacities for EWS are designed and developed through data standardization and availability from 300 hydro-meteorological stations.	Activity 2.2.2.1 Update the database of hydro-meteorological parameters with new information, or interconnect with existing platforms mainly through WMO Hydrohub (enhancing hydrological monitoring and data exchange) and WMO Hydrological Observing System (WHOS) mandate of standardization of data and information management systems. Activity 2.2.2.2 Define the thresholds for floods and drought levels at and around each gauging station and for various risk areas in relationship with past events Activity 2.2.2.3 Thresholds for Floods and Drought risk levels are linked with socio-economic and environmental impact Activity 2.2.2.4 Conduct the water resources assessment in the region to understand the changing value of water level, water quality, in relationship with present status and past events Activity 2.2.2.5 Develop the HydroSOS products (to calculate the daily warning status or outlooks levels for each of the sub-basin and vulnerable areas) for the targeted countries based on above defined thresholds and real time and historical information available at the National level and from Satellite based products.
		Output 2.2.3 Existing products and tools (at least 10) are integrated and visualized in the regional HydroSOS for EWS and integrated within existing national and regional frameworks and initiatives to facilitate planning and risk-preparedness.	Activity 2.2.3.1 Connect existing products and tools into the MHEWS VOLTALARM EWS Activity 2.2.3.2 Design and develop the interface to gather all individual warning levels on the main MHEWS transboundary system Activity 2.2.3.3 Prepare user guide to convey all available knowledge on the interface to the various groups of users (forecasters, IT staff, decision-makers, etc.)
	Outcome 2.3 Strengthened technical capacity and coordination at national and regional level to improve early warning and facilitate response actions to safeguard populations and economic activities	**Output 2.3.1** Developed institutional capacity and awareness at local, national and regional levels (directly to more than 10000 participants) for enhanced impact based early warning services and decision-making.	Activity 2.3.1.1 Design capacity building courses for NMHSs improving their competencies to periodically perform risk scenarios and assessments Activity 2.3.1.2 Carry out trainings and capacity development workshops with the NMHS professionals, local/national agencies and users of the web-based EWS. Activity 2.3.1.3 Organize training workshop for professionals related to hydrology and meteorology, disaster management, and GIS etc. to convey knowledge and improve skills needed for using MHEWS and disseminating early warning services Activity 2.3.1.4 Pilot testing of the MHEWS VOLTALARM EWS during monsoon and dry seasons in the selected pilot locations (as defined under Table 9) to understand the applicability and effectiveness of the early warning services and response actions Activity 2.3.1.5 Identify roles and responsibilities of the individual organizations and define the coordination mechanism to improve the implementation of the water resources management and climate change adaptation measures Activity 2.3.1.6 Organize national consultative workshops (participants from local/national agencies involved in Floods and Drought management) to share the knowledge (new methodologies, concepts and tools for effective forecasting and dissemination of early warnings) from the pilot test locations

Project Components	Expected outcomes	Expected concrete outputs	Activities Planned and agreed jointly with the NMHSs and other partners
		Output 2.3.2 Promote coordinated and accessible national and regional decision tools for integrated climate and water risk adaptation and the developed tools disseminated to practitioners and decision makers.	Activity 2.3.2.1 Identify the linkages with the existing regional Climate Outlook forum disseminating the information available within the region Activity 2.3.2.2 Nominate members for Hydrological outlook group which could be merged with the climate outlook forum at the regional level Activity 2.3.2.3 Organize annual regional Hydro-climate outlook meetings with the existing and nominated members Activity 2.3.2.4 Develop guidance tools or documents for regular coordination and meetings with the Hydro-climate outlook members
Component 3: Promote accessible national and regional decision support tools and coordination to enhance resilient and sustainable climate risk adaptation through long term investments from policies, plans and actions plans (INDC, NAP and NAPA)	**Outcome 3.1:** Improved information base and practices to facilitate implementation of evidence-based strategies for improving policies, plans and actions plans (INDC, NAP and NAPA) with local collaboration	**Output 3.1.1** Best practices and experience from targeted regions and river basins are incorporated to ensure that existing national policies and practices (more than 10) are interoperable in regional cooperation framework.	Activity 3.1.1.1 Conduct consultation with national stakeholders to gather examples of best practices and approaches for water resources management, flood and drought risks reduction and climate adaptation related measures Activity 3.1.1.2 Best practices and evidence-based experiences are documented and used for strengthening resilience and capacities at transboundary, national and local levels to be implemented by NMHSs and the other regional agencies Activity 3.1.1.3 Propose update and implementation arrangements on existing plans, policies and guidelines on water resources management and climate change adaptation through stakeholder consultations. Activity 3.1.1.4 Propose long-term action and recommendations for strengthening resilience and capacities at transboundary, national and local levels to be implemented by NMHSs and the other regional agencies
		Output 3.1.2 Analysis and quantification of socio-economic benefits through national risk reduction strategy on floods and drought based on local collaboration.	Activity 3.1.2.1 Conduct a desk study and focus group community consultations to gather examples of best practices for flood and drought risk reduction and climate adaptation related measures Activity 3.1.2.2 Hold stakeholder consultations and focus interviews to identify the benefits gained from the national and local levels activities on climate change adaptation and disaster risk reductions Activity 3.1.2.3 Develop a short report underlining the potential benefits together with the identified gaps and additional investment needs for optimised benefits and targeted adaptation strategies Activity 3.1.2.4 Develop capacity building documentation for local communities in close collaboration with local stakeholders, flood and drought management committees or groups.
	Outcome 3.2 Strengthened capacities of policy makers and decision makers at national and transboundary level on long term risk management policies, plans and strategies.	**Output 3.2.1** Specific actions prioritized by the relevant institutions towards risk-preparedness and resilience with national and international investments from government and private entities.	Activity 3.2.1.1 Describe the network of the relevant policy-makers responsible for floods and drought management as well as other related fields (water resources, health, agriculture, ecosystem, forestry, soil and land management.) Activity 3.2.1.2 Organize and conduct national workshops to identify the gaps and needs in existing policies and plans with special attention on safeguard actions for minimizing direct and indirect risks arising from the project activities, and to highlight the key long-term strategies for water resources management especially for flood current status and sub-seasonal to seasonal drought outlook Activity 3.2.1.3 Organize trainings and workshops with stakeholders (representatives of communities, local policymakers and decision makers) to disseminate information on future climate and risk changes and obtain qualitative input on strategies, plans and policies. Activity 3.2.1.4 Identify roles and responsibilities of the individual agencies or organizations and define the coordination mechanism to review and update the implementation of the climate change adaptation measures based on good practices identified in the Volta basin targeted countries.

Project Components	Expected outcomes	Expected concrete outputs	Activities Planned and agreed jointly with the NMHSs and other partners
		Output 3.2.2: National and regional risk management strategies in short, medium and long-term integrated into development plans (economic, social, environmental aspects).	Activity 3.2.2.1 Develop action plan for risk management at medium and long term with the output from workshops and consultations with the stakeholders, and present the recommendations to the policy-makers and ministries/ Propose long-term actions for strengthening resilience and capacities at transboundary level to be implemented by national and regional stakeholders Activity 3.2.2.2 Develop recommendations for standard operating procedures (SOP) for jointly preparing and responding to future flood and drought events Activity 3.2.2.3 Launch national consultations in the targeted countries to gather feedback and recommendations on proposed action plans and on the effective coordination between national and transboundary policies in the framework of floods and drought management and climate adaptation Activity 3.2.2.4 Develop a short report underlining the strengths together with the identified gaps and additional needs related to climate and development impacts and disseminate with policy-makers.

B. Describe how the project /programme would promote new and innovative solutions to climate change adaptation, such as new approaches, technologies and mechanisms.

The proposed components of the Volta phase-II deal with innovative solutions, mechanisms and technologies in the following ways:
Under component 1: Enhanced understanding and access to data and information for informed-decision making, risk-based preparedness and adaptation to hydroclimatic variabilities.

Component 1 will ensure that the existing vulnerabilities, capacities, exposure and related risks to Floods and Drought events are assessed and mapped so that the risk zones in the targeted Volta Basin countries are characterized, and priorities are attributed to the most vulnerable areas. Moreover, climate change predictions will help the stakeholders at the local/national/transboundary level to identify the future impacts of climate change variabilities and to provide support in risk informed decision-making. These results could be further updated for other types of natural hazards and climate change adaptation initiatives/measures to study the impacts on various sectors of the environment and water resources. The floods and drought risk maps will be open-source and enable the mainstreaming of results into other initiatives focused on Floods and Drought management in the Volta Basin. Coordinating with the VBA and other agencies (ECOWAS, AGRHYMET) at the regional level will help to promote the methodologies of risks assessment and mapping to other countries in West Africa which are also prone to Floods and Drought events. The preservation of the environmental resources and ecosystem services will be studied by integrating environmental indicators to the more usual human and properties approaches when describing the vulnerability and risks (which are part of component 1 activities). This will be furthermore useful to increase the awareness related to the negative impacts, as well as the benefits, of the environmental resources.
The natural and nature-based solutions for floods and gender mainstreaming in E2E-EWS will help representatives of agencies, organization and communities to develop knowledge and skills enhancing the flood management approach with environmental and social benefits. This approach is rarely included when warning systems are established because the intend is mostly to prevent the loss of lives and properties. In the Volta basin, the interdependency of the human and social impacts with the environmental resources needs to be linked, therefore increasing the resilience capacity of the environment. These adaptation strategies will ensure the transfer of best practices, skills and lessons learned from the pilot-sites trained beneficiaries to the non-targeted actors and communities. Subsequently, the knowledge upscaling and replication of methodologies beyond the pilot sites will be encouraged, which will strengthen the adaptive capacity and resilience of other communities prone to climate-based extreme events. It will also empower individuals to participate in the decision-making processes at local/national/regional level.

Under component 2: Strengthening water resources management through access to hydro-meteorological information and augment regional /national capacity to monitor and assess Hydro-climatic hazards
An integrated multi hazards (floods and drought) early warning system is an immediate need for the Volta Basin countries where timely and relevant information is lacking for announcing incoming hydro-meteorological hazards. In the past, in one part of the countries, there were flooding situation and other parts there were potential hydrological droughts. The integrated EWS will support the Hydro-met agencies to timely monitor multi-hazard situations and take risk informed decision making for warning services to various stakeholders. The end-to-end hydrological monitoring, forecasting and disseminating system will be designed based on a web-based open-source, cost-effective and real-time chain of modules that will enable collection and transmission of timely, accurate, and local data to users.
It must be underlined that the methods for producing warnings will differ depending on the characteristics of the hazard (flood or drought), as both hydrological extremes differ in their spatial and temporal distribution: floods are relatively rapid events, caused by intense precipitation, limited in time and affecting localized areas (compared to drought); whereas drought is a more slow induced event, and might have a much distributed impact both in area and time. On the one hand, the data needed to describe both phenomena can be partially shared, such as meteorological, hydrological and agronomical parameters. On the other hand, the methodology to forecast the two phenomena varies considerably and depends on the availability of different types of meteorological forecasts (from nowcasting for short pluvial events to seasonal and sub-seasonal forecasts for drought onset). The hydrological and agronomical forecasts will be produced by a range of methods, from simple graphs using the current levels of indicators (VCER's, upstream-downstream river water levels, rainfall-water level relationships, various drought indicators) to more elaborated modelling (depending on the existing models developed on some of the subbasins during previous projects. The main point of the approach is to be able to link hydro - meteorological hazards to their consequences on the vulnerable areas from the social and environmental point of view. Flood and drought risks maps are therefore a first major input, which still needs to be built at the country level, and made available to the communities, over the entire watershed.
Information will be transferred to fit local contexts and local languages using multiple technology options including simple message texts on mobile phones, social media, and radio. The goal is to provide localized information to the general public that will be better prepared to the effects of floods and drought. Furthermore, the proposed system will provide possibilities to receive information from users (crowd sourcing) about their observations during the floods and drought events. The web-based early warning system will be made compatible and scalable to integrate other hazards in future, such as fire, diseases etc.
The integrated web-based Early Warning System (EWS) provides a way to disseminate information to national services, civil security, and to the population which can suffer from these both types of extreme events during the same year. It becomes a support tool to foster collaboration and knowledge sharing between institutions and populations.
Moreover, adaptation strategies could be tested through the early warning system at some of the pilot locations during monsoon and dry period. The experience will be shared with other communities having similar socio-ecological contexts in the Volta Basin.

Under component 3: Promote accessible national and regional decision support tools and coordination to enhance resilient and sustainable climate risk adaptation through long term investments from policies, plans and actions plans (INDC, NAP and NAPA)
The countries of Volta Basin must coordinate their responses in managing water resources (excess water during monsoon and transfer of water during dry season). Component 3 includes knowledge exchange, inter-country dialogue and cooperation which will strengthen the development of policy, plans and guidelines for managing shared water resources and climate extreme events. For decades, VBA has been working on protocols on data sharing and coordinated strategies at the transboundary level. The Volta proposed project will facilitate engagement between ECOWAS, AGHYRMET, VBA and the riparian countries in understanding the present challenges and develop strategies, policies and action plans to build robust cooperation on transboundary and national water resource management. The other initiatives under this component will be to:

- Establish mechanisms for information exchange and networking (including exchange visits of officials to other countries to share ideas, knowledge, practices and lesson learned);
- Developing open-source databases with tools, polices and guidelines.
- Framework and expertise for carrying out regular monitoring and evaluation after the project period ensuring long-term sustainability.

Strengthening of stakeholder knowledge through capacity building

Additionally, the capacity building activities at the national and local level will be key in achieving the long-term support: to ensure a better adoption of the innovative solutions proposed in the project. The wide range of training curriculum will involve local and national counterparts and communities to develop knowledge and skills in end-to-end early warning systems for flood management, integrated drought management, hydrological status and outlooks, community-based flood and drought management, mainstreaming gender, roving seminars for farmers on agro-meteorology, etc. These trainings will be delivered based on materials already tested and made available by WMO in the framework of specific activities such as the Flood Forecasting Framework, Associated Programme on Flood Management (APFM) or the Integrated Drought Management Programme (IDMP). These training could also be embedded in wider WMO initiatives (e.g. corresponding to the work plan of the WMO Standing Committee on Hydrological Services) and therefore provide an in-kind commitment from WMO in the development of training materials and the logistical organization of the training workshops. Countries would benefit from this training and at the same time contributing in-kind by having their NMHSs staff attending the workshops or assisting on the local logistical arrangements for holding the workshops.

C. Describe how the project/programme would provide economic, social and environmental benefits, with particular reference to the most vulnerable communities, and vulnerable groups within communities, including gender considerations. Describe how the project/programme would avoid or mitigate negative impacts, in compliance with the Environmental and Social Policy of the Adaptation Fund.

According to the ECOWAS 2021 Analytical Report[36], the socioeconomic analysis of improving hydromet services in West Africa (presented under Figure 14 and Table 14) highlighted very high benefits attained particularly due to flood avoided damages and increased productivity of agriculture and energy sectors and their relative contribution to GDP. Benefit cost estimates showed potential benefits ranging from $4 to $19.5 were obtained for each $1 invested in ECOWAS member states. In Cote d'Ivoire, benefits of $7 were estimated whereas up to $14 in Ghana for each $1 invested in modernizing hydromet services. Ghana presented the greatest benefits from flood-averted damages while in Cote d'Ivoire there are more benefits attached to agricultural productivity through drought management. Applying a conservative BCR of 5:1, a $5 million investment in EWS and DRR measures under VFDM-Phase 2 could generate at least $25 million in avoided losses and increased productivity over the project lifespan.

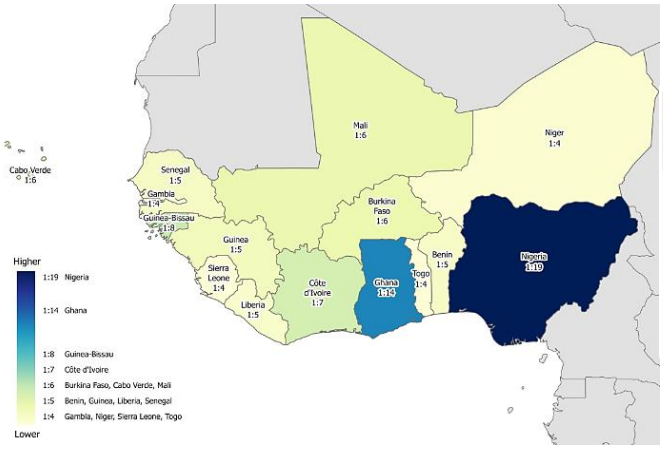


Figure 13 Cost-benefit ratios associated with investment in hydrological and meteorological services in ECOWAS Member states

Table 14 Baseline socioeconomic benefits for hydromet modernization in ECOWAS, actualised 25 years (%, $ millions)

	BENEFIT ESTIMATES *Actualized 25 years*		
DISCOUNT RATE (%)	**3.0%**	**7.0%**	**12.0%**
Flood-avoided damages	$900.00 million	$548.2 million	$324.3 million
Drought crop yield response	$485.75 million	$295.9 million	$175.1 million
GDP unblocked growth (agriculture, energy improved decisions)	$945.9 million	$576.1 million	$340.8 million
Willingness to Pay (WTP) for seasonal climate services	$124.3 million	$75.7 million	$44.8 million
Net Present Value (actualized 25 years)	$2,216.8 million	$1,331.6 million	$770.2 million

The socioeconomic analysis highlighted that investment in Flood Early warning Systems and risk management in West Africa is especially very crucial, with FEWS mostly absent in the region whereby most countries have only basic hydrological services with no FEWS and flow forecasts. A large part of investment would be required for institutional strengthening, including support on cost recovery by enhancing the early warning services and products at national level and contributions from regional centres such as AGRHYMET, ACMAD. This project will enhance these benefits through technical support to improve ICT infrastructure and data management capacity and service delivery capacity to enable service provision in the targeted countries. Cooperation with river basin organisations would facilitate data exchange and support countries with forecasting of floods, droughts and water levels for improved planning and thereby increased economic production and sustained livelihoods. (rural communities have reduced resilience against flood devastation due to limited livelihood options and lack of resources)[37].An early warning system alongside diverse and reliable livelihood options and infrastructure development are needed to decrease vulnerability of communities towards natural disasters. According to ECOWAS and GWP-WA data, annual flood-related economic losses in the Volta Basin exceed $100 million. Scaling EWS and flood-risk planning nationwide could reduce damages by 10–20%, equating to $10–20 million in avoided losses annually in each country. Scaling up VOLTALARM and community-based adaptation can provide timely warnings to an estimated 1.5–2 million people. Studies suggest EWS implementation can reduce disaster-related mortality by up to 30–40%, and injury/displacement by 20%.

[36] Strengthening Weather, Climate and Water Services in West Africa – An Analytical Report; ECOWAS: Abuja, 2021. https://www.ecowas.int/publication/ecowas-hydromet-initiative/

[37] Islam et al, 2020. Factors Determining the Residents' Preparedness against Natural Disasters: A case study of Pakistan Flood-2010.

In line with the Environment and Social Policy of the Adaptation Fund and its principles, the ecosystem approach is fundamental in the concepts of Integrated Flood and Drought Management supported by WMO and GWP programmes and it will be one of the major aspects considered when developing medium and long-term adaptation measures. This will be achieved by taking into account the existing guidance material developed by the Associated Programme on Flood Management (APFM) with its partners based on the IFM concept (e.g. IFM Tool Series and WWF Flood Green Guide). Awareness on prevention, preparedness and response (component 2.3) will mostly involve national agencies, Civil Protection, NGOs, to develop education programs using participative solutions. National policies, regulatory instruments, coordination institutions for risk reduction and climate change impacts are already in place at the level of each individual country but an integrated approach at the scale of the watershed will allow to evaluate the impact of individual measures on the whole water cycle and on the related agricultural development (component 1).

The initial gender analysis conducted for VFDM Phase 2 (as presented under the Gender Assessment report presented under Annex 1) highlights **critical gender disparities and opportunities** in relation to climate resilience, hydro-climatic risk management, and adaptation planning in the two target countries:

1. Differential Vulnerability to Climate Risks

- Women, particularly in rural and riverine communities, are **disproportionately affected** by floods and droughts due to limited access to assets, decision-making structures, and mobility.
- In both countries, **women are primary users and managers of water resources** for domestic and agricultural use yet have limited influence in formal water governance platforms.

2. Gendered Division of Labor and Economic Roles

- Women represent **over 50% of the agricultural workforce (up to 70% in some regions)** in both Ghana and Côte d'Ivoire but tend to engage in smallholder farming with low access to climate-resilient inputs (e.g., improved seeds, irrigation).
- Men are more likely to control land and high-value crops, while women often cultivate food crops for household consumption and local markets.

3. Access to Information and Early Warning Systems (EWS)

- Women have **less access to climate information and EWS** due to lower literacy levels, gendered communication channels, and social norms.
- Current EWS platforms (e.g., pilot VOLTALARM) show **gender gaps in access and responsiveness**, requiring more inclusive design and outreach.

4. Representation in Decision-Making

- Women's participation in community-level DRR, climate adaptation, and water governance structures is limited and often tokenistic.
- Traditional leadership and national policy forums are male dominated, leading to **underrepresentation of women's needs and priorities** in planning processes.

5. Capacity and Agency

- Heavy care burdens reduce women's ability to attend training or participate in climate change adaptation planning and implementation.
- While women's coping strategies (e.g., food preservation, informal support networks) are essential during crises, **these skills are rarely formalized or supported** by institutional DRR systems.
- Existing women's groups and cooperatives present opportunities to **channel adaptation training, finance, and knowledge-sharing** effectively.

Participatory and Inclusive (indigenous, vulnerable, marginalized, etc.) community-led flood and drought management approaches will empower stakeholders by valuing local indigenous and traditional knowledge and ensuring their voices shape risk management, while also preserving cultural traditions, sacred lands, and practices through nature-based approaches. Capacity development and Implementation of the nature-based solutions (like restoring wetlands, forests, or rivers) will support Indigenous ecological practices and help safeguard sacred lands and traditions. The two countries of the Volta Basin count a large number of stakeholders and institutions that will contribute to the development of technologies and trainings proposed in the VFDM phase-2. Risk mapping, risk prevention measures and nature-based solutions, Early Warning System designed to integrate further natural and agricultural hazards, enhanced community (particularly vulnerable groups such as women) preparedness to risk and climate change impact will provide economic, environmental and social benefits as shown under Table 15.

Table 15: VFDM Phase-2 economic, social and environmental benefits

Economic benefits	Social benefits	Environmental benefits
-Water and water-related hazards have a significant effect on economic growth (Sadoff et al., 2015)[38] . -Economic benefits in the short-term will be achieved through disaster risk reduction measures of the project activities, by reducing damage to agricultural land with flood water, restoration of wetlands and other infrastructures through the implementation of Flood and Drought management and Early Warning Systems. The technical knowledge of local communities and agencies will help in planning for climate resilient adaptation interventions, potentially delivering significant	- More than one million people especially farmers, marginalized, indigenous and vulnerable groups etc. in the project locations will be benefiting from the Early Warning System for Floods and Drought (Scaling up VOLTALARM and community-based adaptation), supporting agricultural production and water security. Studies suggest EWS implementation can reduce disaster-related mortality by up to 30–40%, and injury/displacement by 20%. - Timely warning services through EWS will be made available to the Indigenous and marginalized communities etc. so as to strengthen their existing traditional	- Historical data on weather and other relevant environmental variables will be useful to develop the future scenarios with index time series and determine values at risk (such as crop yield, water resources, aquatic habitats, wetlands and farming land). -The proposed early warning system will be able to deliver information regarding the water scarcity or abundance, water quality of the major reservoirs, etc. to the communities and agencies of the Volta Basin. - Restoration of floodplains, wetlands, and riparian zones is planned in targeted areas.

[38] Sadoff C.W. et al. (2015), Securing Water, Sustaining Growth, report of the GWP/OECD Task Force on water security and sustainable growth

environmental benefits as well as cost savings. - Incorporating Indigenous knowledge into local climate adaptation measures will create income opportunities (ecotourism, sustainable land use, agroforestry, watershed restoration). - Exchange of knowledge at a regional, national and local scales will promote the adoption of climate-resilient livelihoods. - Livelihoods of indigenous, marginalized and vulnerable groups especially farmers will be enhanced and the viability of the ecosystems (they depend highly on natural resources) will be strengthened and maintained. This will possibly help to reduce the number of people migrating to urban areas/cities for livelihoods and subsistence. - To increase water security, the countries' efforts will be focused on building flood and drought risk maps for different climate scenarios and adaptation guidance for local governments. The latter will help agencies in revising laws and regulations such as sustainable water abstraction thresholds, building codes and land-use planning. They will also be adjusting economic instruments such water-related environmental taxes, and flood and drought insurance schemes. · Representatives of rural communities will be trained and better organized to use flood plain for income generating activities. They will also provide valuable human resources for future livelihood based on climate change adaptation activities beyond the lifespan of the programme - Effectively and efficient management of water resources in the Volta Basin will ensure energy and water security, which may alleviate the reduction of water for daily-usage and energy supply disruptions.	knowledge (observing change of colour (brown turbid water to black) in the rivers as forecasting of flooding situation, etc. - Involvement of indigenous and marginalized communities in decision making processes and will strengthen self-determination and ensure collective action in managing risks fostering cooperation within and between communities. - Urban population (estimated to be around thousands) will also benefit of the EWS to gain knowledge on natural hazards and be better prepared and more reactive when events will be forecasted - Participation of NGOs, community-based organizations (CBOs) including women's and indigenous groups will be promoted in the awareness activities and decision-making processes related to climate change adaptation and disaster risk reduction. - More gender sensitive approach in the capacity development activities such as attention to the vulnerable groups, involvement of women, elderly and youths etc. will promote social integration in the communities and diversify livelihood on the basis of disaster risk reduction activities. Empowering women through targeted adaptation planning and DRR training can yield multiplier effects on household resilience, food security, and education - Local stakeholders will be involved in the monitoring of the project activities, so as to develop medium- and long-term sustainability. - The involvement of communities, Community Based Organizations (CBO), NGOs and local policymakers in the capacity development activities will help in developing sustainable climate adaptation strategies and early warning systems. - Flood and drought events disrupt school attendance. Reducing such disruptions through timely alerts and planning can indirectly support educational retention for tens of thousands of children, particularly girls.	Even small-scale interventions (e.g., 1,000 ha) can improve biodiversity, carbon sequestration, and water regulation. Restored wetlands may sequester up to 2–5 tonnes of CO_2 per hectare per year, resulting in 2,000–5,000 tonnes CO_2/year from ecosystem interventions. - The project will contribute in lowering the excess demand for natural resources through fair and equitable sharing of water resources, especially at transboundary level - Increased protection against land degradation and desertification will be achieved through the actionable plans and policies at local and s attention to the vulnerable groups, involvement of women, elderly and youths etc. will promote social integration in the communities and diversify livelihood on the basis of disaster risk reduction activities. - Local stakeholders including indigenous communities will be involved in the monitoring of the project activities, so as to develop medium- and long-term sustainability. - Indigenous ecological practices are applied to maintain balance with nature, ensuring solutions are culturally and ecologically sustainable. - The involvement of communities, Community Based Organizations (CBO), NGOs and local policymakers in the capacity development activities will help in developing sustainable climate adaptation strategies and early warning systems. - At national level, a better understanding of the interaction between climate, environment and human factors which impact the sustainable use of natural resources - Availability of information on water ways and channels helping agencies and communities to improve the sustainability of the natural resources through reduced soil erosion and siltation. - Reduced Environmental Degradation: Risk mapping will help avoid settlement or farming in highly vulnerable zones, preventing land erosion and habitat loss

D. Describe or provide an analysis of the cost-effectiveness of the proposed project/programme and explain how the regional approach would support cost-effectiveness.

Until now, limited focus has been put on determining the cost-effectiveness of climate change adaptation interventions (some support were provided from the recently completed VFDM project) across the Volta Basin countries as a whole. As a result, there is limited baseline information that can be used for comparative analyses of adaptation approaches which are sustainable and replicable across the entire Volta Basin. In the VFDM, new solutions were implemented to improve risk reduction and climate change adaptation. Special attentions were given to promote Community of Users, guidance material, decision-support tools, online training, social networks and crowdsourcing which are used and maintained by the stakeholders. All these were tailored according to the local needs and capacities, to account for social and cultural issues. The End-to-End Early Warning Systems was tested with additional climate projections to study the impact of future scenarios on spatial and urban planning and their consequences on the socio-economic development. However, with limited or not so quality data, the accuracy of the results was not adequate and cannot be used for operational and planning purposes.

The basin scale approach was suitable way to identify and implement cost-effective measures but at the country level, previous knowledge from current projects, cannot be considered to have minimum overlap and transfer of methodologies from one area to the other. The development and maintenance of the End-to-End Early Warning System and all related functionalities is still not mutualized and shared depending on the individual needs and uses. The developed methodologies need to be tested at larger scale within the basin, or easily adapted to similar types of environments, therefore creating a community of users jointly considering climate change perspectives will also foster the integration of risk and

climate approaches. The proposed VFDM phase-2 is directly related to the climate change adaptation and disaster risk reduction initiatives, utmost required for the Volta Basin countries; the solutions are participatory, cross-border, innovative and provide positive cost-benefit ratio. The extension of the VFDM project to the country level is a suitable way to identify and implement cost-effective measures as shown under Table 16.

Table 16: VFDM Phase-2 cost effectiveness

Component	Component Cost (US$)	Number of Beneficiaries (approx. from the two countries)	Proposed Benefits	Alternatives to proposed approach and cost
Component 1: Enhanced understanding and access to data and information for informed-decision making, risk-based preparedness and adaptation to hydroclimatic variabilities.	4000000	100000	By improved knowledge on two extreme hazards, vulnerability and climate related risks, more efficient planning and investment decisions will be taken at all levels, on the basis of soft structural measures, to reduce human, environmental, material and livestock losses from sudden or slow onset of Floods and Drought. The proposed interventions of implementing drought risk mapping will lead for pro-active water management and agricultural adaptation for drought resilience. Also building capacities of communities as first responders will reduce the immediate losses due to the climate change events while waiting for the external support to come for assistance (timely response can reduce livelihood losses by 20–30%, saving millions in food aid and recovery costs). Additionally, the capacity development activities for the natural and nature-based solutions to Floods and mainstreaming gender in E2E-EWS-F and Flood Management will enable actual beneficiaries to improve their self- response whilst strengthening the sustainability of impacts. Studies suggest EWS implementation can reduce disaster-related mortality by up to 30–40%, and injury/displacement by 20%. According to ECOWAS and GWP-WA data, annual flood-related economic losses in the Volta Basin exceed $100 million. Scaling EWS and flood-risk planning nationwide could reduce damages by 10–20%, equating to $10–20 million in avoided losses annually in each country. Yield improvements of 10–15% over BAU under moderate drought scenarios. Productivity Gains in Agriculture: Improved climate information and risk mapping can enhance decision-making for over 300,000 smallholder farmers in the basin. If just 5% of these farmers increase yields by 10%, this could result in $6–8 million in added agricultural value annually, based on regional average incomes.	Instead of adequate vulnerabilities, capacities, exposure and risks studies, adoption of structural flood reduction measures, such as the construction of dams or reservoirs to reduce the flow and overflow of river courses are alternative measures. Additionally, the time for dam construction will be highly depending on the political and economic condition of the countries. Environmental consequences of the structural measures will need to be assessed. Also, instead of pro-active water management and agricultural practices, communities will be forced to have groundwater abstraction and boreholes with no recharge plans. Also, Promotion of drought-tolerant seeds without localized suitability assessments.
2. Strengthening water resources management through access to hydro-meteorological information and augment regional /national capacity to monitor and assess Hydro-climatic hazards	10500000	30000000	The End-to-End Multi hazard Early Warning System will be developed with compatible technologies and provide similar types of messages for both Floods and Drought (Up to $3–5 return per $1 invested in early warning systems (WMO, 2022). The beneficiaries will gain knowledge and tools to increase preparedness for extreme events. The MHEWS will support in tested institutionalized drought response plans co-designed with communities. Benefit-Cost Ratio (BCR): Based on World Bank and WMO data, investments in hydrometeorological and early warning systems in West Africa have a BCR ranging from 4:1 to 19.5:1. Especially, Benefit cost ratio estimates showed potential benefits of $7 for each $1 invested in Cote d'Ivoire, and up to $14 in benefits in Ghana for each $1 invested. Applying a conservative BCR of 5:1, a $5 million investment in EWS and DRR measures under VFDM-Phase 2 could generate at least $25 million in avoided losses and increased productivity over the project lifespan.	Early warning systems are developed independently for both Floods and Drought and not coordinated at the country scale leading to adhoc responses led by local government/NGOs. This approach will require more investment cost and time as it will need additional infrastructures and resources to manage the system. Furthermore, uncoordinated efforts will decrease the benefits of the investments. The decision procedures that will be designed for each separate projects will create difficulties when a joint system will be planned.

3. Promote accessible national and regional decision support tools and coordination to enhance resilient and sustainable climate risk adaptation through long term investments from policies, plans and actions plans (INDC, NAP and NAPA)	1500000	1000 directly (several millions indirectly)	The policies, plans and guidelines on climate change adaptations disaster risk reduction and environmental issues will be improved at local and national level. By concentrating additional efforts on two major natural hazards at national levels, the national and regional policies will be reinforced, and more effective water management agreements will be implemented. Tailored Drought Management policies are formalized and used for national or international investments A proactive drought policies or plans are more cost-effective than reactive emergency responses. Proper and updated national policies and planning on drought results in 80% of adaptation investments from government and international financing directed to agriculture yield long-term productivity, poverty reduction, and ecological restoration	The alternative to the joint riparian countries is to strengthen their own governance system in silos to manage Floods and Drought events without sharing experience and learning from each other at the transboundary or regional level. Lack of or unavailability of drought management policies at national and local levels can lead to economic losses leading to social and financial stresses.

The sustainability of VFDM-Phase 2 interventions is supported by:

• Institutional integration: Activities are embedded within national adaptation and disaster risk management frameworks, ensuring continued relevance and funding pathways.

•Local ownership and capacity: Community involvement in planning and implementation ensures that knowledge and tools remain locally usable and maintained.

•Scalable systems: The expanded VOLTALARM EWS is designed to integrate drought, flood, and climate information services under a unified platform, reducing duplication and increasing cost-efficiency.

•Nature-based solutions (NbS): These provide self-reinforcing environmental benefits over time (e.g., increased groundwater recharge, biodiversity conservation), which reduce dependency on external inputs.

E. Describe how the project/programme is consistent with national or sub-national sustainable development strategies, including, where appropriate, national or sub-national development plans, poverty reduction strategies, national communications, or national adaptation programs of action, or other relevant instruments, where they exist. If applicable, please refer to relevant regional plans and strategies where they exist.

The proposed project activities align with national and regional development strategies, ensuring coherence with existing policies and frameworks. The project is designed to strengthen climate resilience, disaster risk reduction, and water resource management across Ghana and Côte d'Ivoire by integrating national adaptation and development priorities. The project significantly advances national adaptation planning efforts by:

1. Enhancing climate monitoring and forecasting capabilities, directly addressing NAP/NAPA priorities for water resource management and resilience.
2. Developing national and regional early warning systems, supporting adaptation goals in disaster risk reduction and hydroclimatic risk management.
3. Strengthening water governance and policy integration, ensuring sustainable climate adaptation aligned with national priorities.

By integrating with existing NAPs and NAPAs, the project ensures long-term sustainability and resilience to climate change impacts across all two target countries.

The project significantly advances water resource management and early warning systems in all target countries by:

1. Strengthening climate data collection and accessibility, supporting NDC commitments to hydrometeorological monitoring and disaster risk reduction.
2. Developing national and regional early warning systems, aligning with National Adaptation Plans (NAPs) and Disaster Risk Reduction (DRR) strategies.
3. Enhancing community-based adaptation by improving flood forecasting, water status monitoring, and climate risk assessments.

By integrating national and regional policies, the project ensures coherence with existing climate commitments, supporting each country's long-term adaptation and sustainable development goals.

The project directly supports national adaptation strategies, enhancing resilience to climate change impacts in water and disaster-prone sectors.

The proposed Volta programme aims at reinforcing the role of national agencies, especially NMHSs. The Head of the Meteorological Services, acting as WMO Permanent Representatives and their Hydrological Advisors, form a network of focal points with the Ministries ensuring that the activities of the Volta phase-II will follow national strategies and action plans.

Alignment with Regional Plans and Strategies At the regional level, the project aligns with:

- ECOWAS Disaster Risk Reduction (DRR) Strategy (2015-2030): The project strengthens flood early warning systems and community-based adaptation, contributing to regional disaster preparedness goals.
- Volta Basin Authority (VBA) Strategic Plan: The project expands upon VBA's Flood and Drought Management Program, ensuring regional coordination in hydroclimatic monitoring and risk-based adaptation.
- West African Science Service Centre on Climate Change and Adapted Land Use (WASCAL): The project enhances climate information services and capacity-building, aligning with WASCAL's objectives.
- African Union Agenda 2063 and the African Water Vision 2025: By improving water security and disaster resilience, the project contributes to continental climate adaptation and sustainable development goals.

Consistency with climate change adaptation and sustainable development strategies of the Volta Basin Authority

Improving climate change adaptation and developing floods and drought early warning systems are part of the regional and national sustainable strategies supported by the riparian countries. The project aligns with the strategies and plans to develop transboundary water management framework for the Volta Basin. The Volta Basin Authority (VBA) has the mandate to harmonize national policies addressing the management of the water resources of the whole basin, indeed uncoordinated policies threaten the sustainability of the natural resources, as well as the socio-economic development of the six countries. Additionally, VBA is developing the governance framework for data sharing and information exchange related to water resources management between the countries.
The Master Plan for Development and Sustainable Water Management (MPDSWM) developed by the Volta Basin Authority with support of GWP-West Africa is a detailed IWRM-based Development Plan that will provide an integrated basin perspective to the basin's development and management. It will include the water development and management priorities selected by all basin stakeholders and ensure coherence in decision-making by incorporating the different national programmes and sectoral development plans.

Alignment with National Development Plans and Climate Strategies
The project supports Nationally Determined Contributions (NDCs) in all target countries by addressing adaptation priorities related to water resource management, flood early warning systems, and climate resilience. Additionally, the project aligns with each country's National Communications to the UNFCCC, reinforcing commitments to climate adaptation, disaster risk reduction, and sustainable development as shown under Table 17. By integrating national and regional priorities, the project ensures long-term sustainability, complementing existing frameworks and enhancing resilience against hydroclimatic risks.

Table 17: Alignment with National Development Plans and Climate Strategies

Country	Policy/Strategy/Plan	Purpose/description	Project's contribution
Côte d'Ivoire	National Adaptation Plan (NAP, 2015-2025)	Emphasizes climate-smart water resource management, flood control, and improved meteorological services Highlights the importance of climate risk reduction, integrated water resource management, and early warning systems for adaptation.	The project aligns with Côte d'Ivoire's strategy to improve hydro-meteorological monitoring and water governance. -Contributes to regional flood early warning and climate adaptation measures, consistent with Côte d'Ivoire's NAP priorities. -Enhances decision support systems for water resources management, strengthening resilience to climate change impacts. Linked with the outputs: 1.1.1, 1.2.1, 1.2.2,2.2.1,3.2.2
	National Development Plan (PND, 2021-2025)	Promotes disaster risk reduction and early warning systems to mitigate climate-related shocks.	Linked with the outputs: 1.1.1, 1.2.1, 1.2.2,2.2.1,2.3.1, 3.1.1,3.1.2, 3.2.2
	NDC (updated 2022)	Includes commitments to strengthen flood early warning systems, improve water governance, and enhance resilience in coastal and inland flood-prone areas.	The project contributes to climate data accessibility and disaster risk preparedness, in line with national targets. Linked with the outputs: 1.1.1, 1.2.1, 1.2.2,2.2.1,2.3.1, 2.3.2, 3.1.1,3.1.2, 3.2.2
	Third National Communication to UNFCCC (NC3, 2017)	Stresses the need for more reliable climate and hydrological information for disaster risk management.	The project provides decision-support tools for flood risk monitoring and adaptation planning. Linked with the outputs: 2.2.1,2.3.1, 2.3.2, 3.1.1,3.1.2,3.2.1, 3.2.2
Ghana	National Climate Change Policy (NCCP, 2013)	Prioritizes disaster preparedness, water resource management, and community adaptation	Linked with the outputs: 2.2.1,2.3.1, 2.3.2, 3.1.1,3.1.2,3.2.1, 3.2.2
	-National Adaptation Plan (NAP, 2021) -Medium-Term National Development Policy Framework (MTNDPF, 2022-2025)	Emphasize climate-resilient infrastructure, early warning systems, and capacity-building for vulnerable communities	The project contributes to strengthening hydro-meteorological monitoring, which is a core priority under Ghana's NAP. Enhances flood and drought early warning systems, aligning with Ghana's climate risk reduction efforts. Supports integrated water resource management (IWRM) for climate resilience, a key adaptation measure in Ghana's NAP. Linked with the outputs: 1.1.1, 1.2.1, 1.2.2,2.2.1,2.3.1, 3.1.1,3.1.2, 3.2.2
	Nationally Determined Contribution (updated 2021)	Identifies early warning systems, water resources management, and community-based adaptation as key priorities	The project supports Ghana's commitment to enhance climate information services for agriculture, water, and disaster management Linked with the outputs: 1.1.1, 1.2.1, 1.2.2,2.2.1,2.3.1, 2.3.2, 3.1.1,3.1.2, 3.2.2

	National Communications to UNFCCC - Fourth National Communication (NC4, 2020)	Emphasizes the importance of hydrometeorological monitoring, flood forecasting, and disaster preparedness to reduce climate vulnerability.	The project aligns with national adaptation strategies by improving climate data access and forecasting capabilities. Linked with the outputs: 2.2.1,2.3.1, 2.3.2, 3.1.1,3.1.2,3.2.1, 3.2.2

F. Describe how the project/programme meets relevant national technical standards, where applicable, such as standards for environmental assessment, building codes, etc., and complies with the Environmental and Social Policy of the Adaptation Fund.

The project is in compliance with the Environmental and Social Policy (ESP) of the Adaptation Fund, and congruent national and environment and social regulations of all the targeted two countries of the Volta basin. This includes the requirement that activities funded by the Adaptation Fund reflect local circumstances and needs and draw upon national actors and capabilities.
In addition, the programme activities will be validated by national partners, including the Permanent Representatives and hydrological advisors of the National Meteorological and Hydrometeorological Services to WMO.
The national partners will be consulted during the development of the full proposal to ensure that all activities comply with relevant national standards, as well as the environmental and other statutory laws and regulations of the two riparian countries. If required, Environmental Impact Assessments of the on-the ground activities will be undertaken.

Other national laws on environmental and social assessment in each of the countries will be followed during the project design, planning and implementation to ensure compliance and to complement with the ESP of Adaptation Fund. The following list of laws and regulations presented under Table 18 cover most of the fields that are included into the Volta project: environment protection and impact assessment, sustainable development, water resources management, risk and crisis management, public participation, labour, regional and local responsibilities.

Table 18: Alignment with national technical standards

Country	Relevant standards	Linkage with Volta Phase-2 proposed project and the project's compliance status	National Standards and Project Compliance Examples
Côte d'Ivoire	• Law No O96-766 of 3 October 1996: Environment Legislation (to set up the rules and procedures regarding the impact of development activities on the environment) of Côte d'Ivoire • Law No. 98-755 of December 12, 1998: Water Legislation • Decree No. 2012-988 of October 10, 2012, establishing, attributing, organizing, and operating the National Platform for Risk Reduction and Disaster Management • Law 98-755 of December 23, 1998, on Water Code. • Decree No. 96-894 of November 8 ,1996, on Environmental Impact • Law No. 98-750 of 23 December 1998 on Rural Land • Law No. 2014-390 of June 20, 2014 on sustainable development	The environmental legislation, water codes, and disaster risk reduction decrees provide the statutory requirements for environmental impact screening, water resource utilization, siting of monitoring infrastructure, and coordination with national risk management platforms to generate and disseminate warnings. Similarly, the rural land and sustainable development laws ensure that project interventions related to land access, infrastructure placement, and community-based adaptation measures adhere to established national procedures and safeguards. Components 1, 2 and 3 mainly activities under outputs 1.1.1, 1.1.2, 1.1.3, 2.1.1, 2.1.2, 3.1.1 and 3.1.2. Risk maps and EWS to comply with the social, economic and environmental thresholds will be developed to understand the impacts and identify necessary mitigation and management measures. Concept note or ToRs of each activity will be developed and shared with relevant stakeholders of the countries before implementation to ensure compliance with different applicable standards, laws or acts to avoid any risks to population, environment and infrastructures. This ensures that the project's interventions are nationally validated, legally compliant, and supportive of long-term institutional and regulatory strengthening in both countries.	Risk mapping (Output 1.1.1) and flood/drought modelling and forecasting (Outputs 2.1.2 and 2.2.1) incorporate national water basin regulations. Infrastructures and responsibilities for monitoring and information dissemination comply with national laws and standards Hydrological data collection activities (Output 2.1.2) coordinate with the Water Resources and Hydrological agencies for data-sharing agreements and compliance with river monitoring procedures. Before installing or rehabilitating hydrological or meteorological stations (Output 2.2.1), the project conducts environmental screening and, if required, EIAs and SIAs in accordance with the national procedures and laws. Early warning services (for example: following Ghana Meteorological Act and Ghana Hydrological Authority standards and procedure in Ghana) and decision making (Output 2.3.1) are validated through national DRR entities (NADMO), ensuring alignment with national alert protocols. Community-based adaptation measures (Output 1.2.1) ensure land access rights are verified through local authorities before implementation. Risk maps (Output 1.1.1) are shared with national, city and district planners to support zoning and flood-sensitive development
Ghana	• The Environmental Assessment Regulations 1999, L.I. 1652 and its Amendment Regulations, 2002; • EPA Act (Act 490) 1994; • Ghana Infrastructure Plan (2018-2047):The Water Resources Commission Act 1996, Act 522; • The Local Government Act 1993, Act 462; • The Lands Commission (LC) was established by Article 258 of the 1992 Constitution and the Lands Commission Act, 2008 (Act 767) • Town and Country Planning Ordinance (Cap. 84) No. 13 of 1945; • The New Labour Act 2003, Act 651; • The State Lands Act 1962, Act 125; • The Lands (Statutory Wayleaves) Act, 1963;	The Environmental Assessment Regulations (L.I. 1652) and EPA act (Act 490), Water Resources Commission Act, local government legislation, land-use and planning regulations, and NADMO Act collectively establish the standards for environmental and social assessments, permitting processes, water management, land acquisition, and disaster management operations. These frameworks guide all physical installations, data-sharing arrangements, and community-level interventions implemented under the VFDM Phase-2 project. Components 1, 2 and 3 mainly activities under outputs 1.1.1, 1.1.2, 1.1.3, 2.1.1, 2.1.2, 3.1.1 and 3.1.2. Risk maps and EWS to comply with the social, economic and environmental thresholds will be developed to understand the impacts and identify necessary mitigation and management measures. Concept note or ToRs of each activity will be developed and shared with relevant	

	• The Rivers Act, 1903 • Ghana Meteorological ACT 682, 2011 • National Disaster Management Organisation's (NADMO) enabling Act (Act, 927) 2016 provides the necessary legislative framework for disaster risk reduction.	stakeholders of the countries to ensure compliance with different applicable standards, laws or acts to avoid any risks to population, environment and infrastructures.	planning in accordance with the Town and Country Planning Ordinance. Community consultations (Activity 1.1.1.3) and community-based adaptation (Output 1.2.1) are conducted under the authority of district assemblies following the local planning guidelines and agreement with the community agreement.

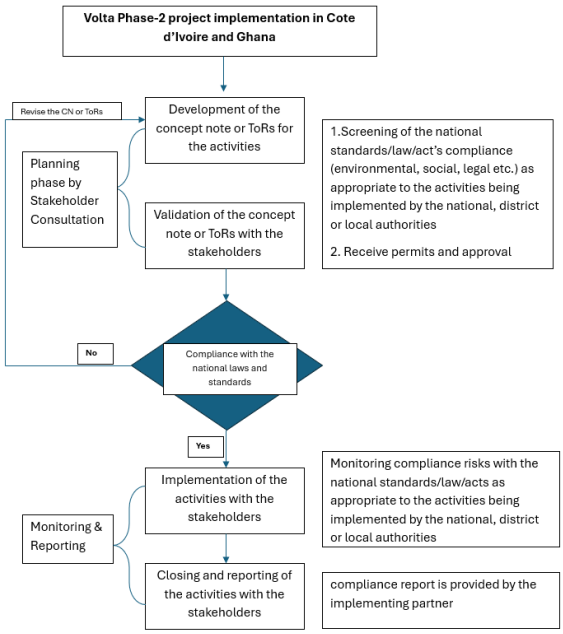


Figure 14: Logical flow diagram on how each national laws, standards and acts will be screened and compliance will be applied, monitored and reported

G. Describe if there is duplication of project/programme with other funding sources, if any.

In the region, funding for environmental, disaster risk reduction and climate change projects has been, and still is, provided by financial institutions such as World Bank, AFD and other Development Banks, GEF, FAO, WWF, national development agencies. Several programmes and projects have already been screened for avoiding duplication and synergies. A summary of the main findings of this first survey based on existing reports, publication, and meetings with participants is presented in the following table 19:

Table 19: Alignment with other on-going and completed projects

Projects or initiatives on-going or completed	Objective and Target population	Possible overlaps or not between the projects or initiatives and Volta phase-2	Synergies and complementarities with the proposed VFDM phase-2 (including lesson learned if any)
Early Warning for All (EW4All) Initiative (2025-2027) of Ghana https://www.meteo.gov.gh/news/ghana-validates-comprehensive-roadmap-for-early-warning-systems/	Launched in October 2024, this initiative aims to enhance Ghana's preparedness for climate-related hazards by ensuring timely and actionable information reaches all populations (more than 30 million) for actionable response or anticipatory actions. It focuses on disaster risk knowledge, observations and forecasting, dissemination and communication, and preparedness to respond.	There is no possible overlap as Volta phase-2 project will support in developing EWS which can help in timely monitoring of climate related hazards and ensuring timely and actionable information reaches all populations	The Volta phase-2 project will support in implementing the EW4All action plan developed by the stakeholders of the country to improve early warning services to cover or protect everyone from hydro-meteorological hazards. The lesson learned is mainly to ensure all the national EW4All stakeholders are involved in the design and implementation of activities under different Pillar of the EWS leading to a coordinated effort.
Integrating Flood and Drought Management and Early Warning for Climate Change Adaptation in the Volta Basin (VFDM) https://www.adaptation-fund.org/project/integrating-flood-drought-	The project support in the development and operationalization of the Transboundary early warning system for the Volta Basin region covering approximately 10 million people (only for the portion of the Ghana and cote d'Ivoire that comes under the Volta Basin)	There is no direct overlap but rather complementary in terms on scaling the EWS with additional products on sub-seasonal and seasonal forecasts on riverine floods, flash floods and hydrological droughts, updated impact-based forecasting incorporating available new data and	The project will use of existing tools, skills, knowledge of the trained professionals in scaling the risk maps, EWS to cover more than 30 million people of Ghana and Cote d'Ivoire with early warning services to build preparedness and resilience to climate change events in the two Volta Basin countries reducing loss of lives and improving livelihoods

management-early-warning-climate-change-adaptation-volta-basin-benin-burkina-faso-Côte-divoire-ghana-mali-togo/		information from the government agencies	
Flood Forecasting and Alert System for West Africa (FANFAR)) implemented by SMHI in collaboration with the regional climate center AGRHYMET and national agencies such as General Directorate of Water Resources (DGRE) in Côte d'Ivoire. https://fanfar.eu/	To improve operational flood forecast and alert system through model development, capacity building, and knowledge exchange mission for the entire West Africa (including for the entire region of Ghana and Cote d'Ivoire covering more than 30 million people)	There is overlap of the EWS between the two projects, However the FANFAR EWS is operational and used by only Hydrological agency (no products and information for Meteorological agency are provided) as compared to the VOLTALARM EWS which is for meteorology, hydrology and disaster management agencies	Integrate FANFAR's regional hydrological forecasting tools into the national early warning systems, enabling real-time data exchange, harmonizing multi hydrological forecast models, and improving cross-border coordination and interoperability between national and regional systems. The lesson learned from the FANFAR project is to ensure the involvement of the Hydrological Services to gain their support in terms of sharing the calibration and monitoring data related to water level and discharge which will increase the accuracy of the models. The VFDM phase-2 will ensure to involve the hydrological agencies from the design phase to ensure their commitment and support as continued in Volta phase-1 project
Reversing Ecosystem and Water Degradation in the Volta River Basin (REWarD-Volta River Basin) (in preparation) https://www.thegef.org/project/reversing-ecosystem-and-water-degradation-volta-river-basin-reward-volta-river-basin	Reverse ecosystem and water degradation and support integrated ecosystem-based development in the Volta River Basin through strengthened transboundary governance and restoration and conservation of ecosystems for sustainable livelihoods. The REWARD is proposing to develop community-based drought early warning system (covering not all communities and without impact based) using Annual surface water resource models and decision support tools	There is no overlap as the REWARD project is developing only for the Volta Basin region whereas Volta phase-2 will cover the entire region of the two countries. The EWS developed is not operational and used by the mandated and authoritative national meteorological and hydrological services of the two countries	The REWarD project is also planning to set-up an Early Warning System for droughts in the Volta Basin region. The WMO proposed project will build on the tools developed on maintaining the biodiversity and ecosystem goods and services in the Volta Basin by developing partnerships and using the methodologies and approaches proposed by REWarD. Based on the experience from REWARD, WMO will understand the data sharing mechanism deployed by the REWard project to ensure real time monitoring tools and data sharing by national agencies of the two countries.
Greater Accra Resilient and Integrated Development (GARID) Project https://garid-accra.com/	This project includes the development of a Flood Early Warning System (FEWS) for the Greater Accra Region with 5 million people. The system utilizes sensors and modeling tools to provide advanced notifications of flood-prone areas, helping residents take preventive measures	There is no overlap as the GARID project is developing urban flood forecasting for shorter scale (0-3 hours) while Volta phase-2 is supporting in the development of the riverine, urban and flash flood system for shorter, medium and seasonal scale	The Volta phase-2 project will use the existing tools, skills, knowledge of the trained professionals in scaling the flood and drought risk maps, EWS to build preparedness and resilience to climate change events in the two Volta Basin countries. The installation of the sensors from GARID project for measuring the water level and precipitation will be used for the development of the MHEWS for the two countries. The sustainability mechanism or agreement for the GARID outputs could be assessed and applied for the Volta phase-2
RAIN - Sustainable Technologies and Services for Adaptation to Climate Change in Flood- and Drought-prone Settlement Areas in Ghana https://bmbf-client.de/en/projects/rain	In the RAIN joint project, the research association aims to combine an early flood warning system with intelligent water management and supply concepts and identify potentials for sustainable water use through training and further education measures among population groups and decision-makers of Accra and Kumasi region covering approximately 5 million people.	This is a research project and not an operational project so there is no direct overlap	The Volta phase will check and use the data and information for the development of flood and drought monitoring and forecasting products for the early warning system to improve resilience of the Vulnerable population in Ghana especially scaling the applied research concepts into operational products once found effective and sustainable. It is important to integrate the research work into operational practice if found effective and sustainable. The VFDM phase-2 project will check the products developed and identify ways to integrate in the national EWS
Integration Of Climate Change Adaptation And Mitigation Measures in The Concerted Management Of the WAP Transboundary Complex: Adapt-WAP Project https://www.adaptation-fund.org/wp-content/uploads/2017/04/A	The Adapt WAP project of the Sahara and Sahel Observatory (OSS) project targeting approximately 1.45 million people is planning to establish a multi-risk early warning system (MREWS) over an area on the North-Eastern part of the Volta basin in Benin, Burkina Faso and Niger. The system aims at improving resilience of agricultural communities and vulnerable ecosystems.	There is no geographical overall but there is complementarity in using the develop tools and products such as Improve Strategic reference documents, i.e. development and management plans, by integrating the climate change issues and Early Warning System and providing relevant and timely information on the occurrence of extreme weather events in the WAP Complex and its adjacent areas which Volta phase-2	Both projects will be able to learn from each other experiences and challenges, especially as OSS will be invited to participate to the advisory committee of the Volta project. A part of the results and methodologies of Adapt-WAP will be complementary to the Volta programme as both projects aim at improving early warning: the type of information provided by the OSS multi-risk early warning system (MREWS) could be integrated into VOLTALARM and therefore extended to the scale of the Vtwo targeted countries. The methodology for crop warnings proposed in Adapt WAP could be

DAPT-WAP-CN-OSS-AF-April2017.pdf		can learn and use it for the development in the two targeted countries.	linked to VOLTALARM EWS (including for Ghana and Cote d'Ivoire) similarly to an experiment on pilot sites. Adaptation solutions of Adapt WAP to improve the resilience of ecosystems and livelihoods could be integrated while developing Components 2 and 3, and some of them could be further transferred in the different countries/regions of the West Africa.
WANEP-CI Early Warning System https://wanep.org/wanep/early-warning-response/	The Ivorian section of the West Africa Network for Peacebuilding has established an independent early warning system focusing on human security, which includes aspects of environmental hazards especially supporting more than 10 UN and other conflict-based organizations	There is no strong functional overlap: WANEP-CI does not appear to deliver climate or flood-drought early warning, but conflict-related early warning	Use of existing data, tools, skills, knowledge of the trained professionals in scaling the risk maps, EWS to build preparedness and resilience to climate change events in the two Volta Basin countries including impact-based warning services for the conflict regions and internally displaced populations vulnerable to climate change events
The West Africa Coastal Areas Management Program (WACA) (2015-2020) http://www.worldbank.org/en/programs/west-africa-coastal-areas-management-program	Funded by the World Bank, the West Africa Coastal Areas Management Program (WACA) covering over 20 million population provides convening platform that helps countries access expertise and finance to sustainably manage growing coastal erosion and flooding problems. Countries already participating in the program include Benin, Côte d'Ivoire, Ghana, and Togo.	There is some geographic overlap: Volta Phase-2 is in Ghana and Côte d'Ivoire. However, WACA works in the coastal zones of those countries. World Bank+3adaptation-fund.org+3World Bank+3 WACA focuses on *coastal zones* (erosion, flooding, pollution), while Volta Phase-2 is cantered on the *entire two countries*, which includes inland and watershed-based interventions (flood/drought resilience, impact based early warning, etc.). So, not all WACA zones overlap with Volta-phase-2 intervention areas.	The Volta phase-2 project will collaborate with WACA to gain technical expertise in identify the needs and proposing adequate early warning solutions for coastal floods to be possibly included in the future into the VOLTALARM system as this can help the hydrological and meteorological services of the two targeted countries to monitor coastal flooding (linked with riverine flooding) and timely disseminate advisory messages to the civil protection and population
The West African Science Service Centre on Climate Change and Adapted Land Use (WASCAL) (on-going) http://www.wascal.org/	WASCAL is a research-focused program designed to help tackle the challenge of climate change in West Africa countries (covering more than 400 million population) and thereby enhance the resilience of human and environmental systems to climate change and increased variability.	There is a geographical overlap because WASCAL includes Ghana and Côte d'Ivoire and specifically mentions the Volta Basin as part of its research scope. However, there is no operational system and products developed and used by national agencies mandated for monitoring climate hazards.	Link with the WASCAL Centre will be initiated to benefit from its infrastructures, databases and research capacities (data and models used) and experience in the field of vulnerability, capacities (availability of more than 1000 trained experts and academic students), exposure and risks related to Floods and Drought Events, as well as trends in global climate and land-use changes on water resources in the Volta basin. This will be linked and used during the development of the risk maps, climate scenarios and MHEWS for the two targeted countries
The White Volta and Oti basin Flood Forecasting System (2012-operational till date) http://www.worldbank.org/en/news/feature/2014/10/01/drmhubtokyo-country-program-ghana-strengthening-flood-management-in-volta-basin	The World Bank with resources from the Global Facility for Disaster Reduction and Recovery (GFDRR) financed the development of a flood forecasting system on more than 800km of the White Volta River from the border with Burkina Faso to Lake Volta covering more than 1 million population. This forecasting system is operational since 2012.	There is geographical overlap between the projects however the existing FEWS system is outdated and will be updated with new data and calibration (discharge measurement) information for flood forecasting	Component 2 of the Volta phase-2 will build on the existing flood forecasting capacities and integrate the output of the early warning system on the White Volta into the national early warning system. The trained staff will be involved in the design and development of the multi hydrological models and impact based EWS in Ghana under the proposed project. The sustainability and operational use from 2012 (more than 13 years) of the FEWS systems will be checked with the Ghana Hydrological Authority and similar approach will be adopted for the Volta phase-2 project in the two countries

H. If applicable, describe the learning and knowledge management component to capture and disseminate lessons learned.

Components 1, 2 and 3 include dedicated outputs related to the documentation and dissemination of knowledge generated through the proposed activities. The dissemination of knowledge and good practices will enhance the learning achievements and could further facilitate the replication of success stories by government agencies and communities facing similar issues in other regions or globally. Different ways are planned to ensure proper coordination and to widen the dissemination of the project outputs to a larger circle of institutions and communities in the two targeted riparian countries of the Volta Basin.

1) Knowledge Management and Experience sharing

- ✓ Development of e-learning module(s) for capacity building of key stakeholders. Online learning and training will be an option for those (e.g. representatives, local agencies, etc.) who cannot attend events, conferences and workshops. The modules will be accessible to the programme stakeholders and to a certain extent to the general public and local organizations.
- ✓ As solutions should be co-designed, co-developed and co-implemented in a trans-disciplinary, multi-stakeholder and participatory context, a "Living lab" could be also created in the frame of the proposed Volta programme. In this "Living lab", citizens, organizations, policymakers and other stakeholders will be involved in a multidisciplinary approach where each participant could contribute with his knowledge and

experience about the Floods and Drought Management and/or EWS. Discussions and exercises in groups, round tables and/or presentations could be implemented to stimulate discussions, as well as to develop and test innovative solutions in real world conditions.

- ✓ The programme also envisages to create a Community of Users (CoU) to coordinate a collaborative effort between civil society, community groups, private companies, research institutions, international organizations, and public sector to exchange knowledge, share expertise and discuss about best practices.
- ✓ The contribution to the Community of Practice on Flood Management and End-to-End Early Warning Systems which is being created in the framework of the activities of the WMO Standing committee on Hydrology and Agri Meteorology.

2) Outreach to the wider public

- ✓ Facebook, LinkedIn and Twitter will serve as a wider dissemination strategy to update information, specially targeting the young generation.
- ✓ Mass media channel such as radio services will also be one effective information dissemination strategies as it is widely used in the Volta countries.
- ✓ Leaflets and panels (in the buildings of the partners and on the pilot sites) highlighting the lessons learned and success stories will be shared with stakeholders and in social media for the general public, emphasizing the importance of the programme activities and achievements.
- ✓ Other dissemination tools such as videos, comic books and infographics will be used to reach a wider non-specialized public, using a non-technical language and, if necessary, local language of the member countries. The comic books and case studies could be turned into videos with a storyboard avoiding scientific terms. With the contribution of WWF, the content of the Flood Green Guide could be divided by themes or chapters to develop a series of 2-5 minutes' video that could be part of training materials.

3) Technical reports/documents and dissemination of the project results:

- ✓ The project activity reports (both in English and French, and when needed in local language) will be disseminated via a web portal, briefs to stakeholders, press releases, national and climate change and disaster risk reduction forums, scientific publications and development of awareness raising tools (digital storytelling, video, success stories etc.)

4) Post-programme completion assessment

- ✓ A post-programme assessment activity will be conducted with the government representatives and focal point of communities to determine the lessons learned, impacts and sustainability. The assessment report will be prepared and shared with relevant organisations for any follow-up activities.

5) Crisis communication

- ✓ Presently, communications between agencies occur always through phone calls, emails and short messaging service. Automatic systems are not in place to monitor the activities of all others and trigger an emergency alert. The development of a communication procedure between the partners and the decision-makers will be one of the solutions provided on the VOLTALARM platform
- ✓ The use of social media such as Whatsapp, Facebook and Twitter for communication between the institutions will also be given some attention.

6) Organisation and participation to conferences and other events

- ✓ Workshop involving partners, key stakeholders, end-users, beneficiaries and international partners will be organized about once a year to present the progress of the programme and to ensure a larger communication outside of the basin, the exchange of information, collection of feedback and coordination of activities.
- ✓ The participation to conferences, meetings, workshops and trainings of the programme partners will provide the opportunity to discuss information and findings about Integrated Floods and Drought Management-EWS approach and tailored materials for the different stakeholders in the Volta basin.

7) Dissemination of results through external institutions

- ✓ Development and humanitarian agencies, NGOs and other actors in charge of the implementation of programmes could use the flood and drought management products and develop actions in their field of competence (e.g. identification of community-based flood management solutions for populations living in small catchments of the basin).
- ✓ Similarly, researchers and other public institutions could work on the base of the actions developed under the Volta Project, to further engage in the development of adaptation measures (e.g. assessing climate change impacts and solutions in specific locations).
- ✓ Through collaboration with the national institutions responsible for technological transfer, private companies working on innovative solutions will be contacted to develop national projects that integrate our identified solutions and disseminate them within their areas of work/sectors.
- ✓ The success stories and progress of the Volta project phase-II will be published using the communication media of the implementing and executing entities
- ✓ New guidance material in the line of the APFM Tools series http://www.floodmanagement.info/tools/ could be drafted to promote the results of the Volta programme, as well as the case studies on the basis of the pilot testing.

I. Describe the consultative process, including the list of stakeholders consulted, undertaken during project/programme preparation, with particular reference to vulnerable groups, including gender considerations, in compliance with the Environmental and Social Policy of the Adaptation Fund.

During the implementation and closing of the VFDM project, various studies and discussions, evaluation-based assessment reports were drafted by the external consultants in 2024 for each riparian country highlighting major issues and priorities of actions for flood and drought management going forward. The final evaluation report is available here:
https://fifspubprd.azureedge.net/afdocuments/project/6324/Independent+Final+Evaluation+of+the+VFDM+project+_final_report_final_30122024_Update.pdf

During this same period (namely, in April 2024), a consultation was carried out by the VFDM project partner in the Volta basin area of Côte d'Ivoire (Zanzan district in the Gontougou region). The team visited the local and regional authorities in Bondoukou (as well as the local NGO "LaCibes - La Colombe Ivoirienne pour le Bien-Etre social") and the Sangabili village communities, consulting the Youth's Association, the Women Association, the traditional and religious authorities. Moreover, a general assembly with representatives of the two Sangabili communities –

Koulango and Lobi, living in two separated neighborhoods - was also held. Around 60 people were involved in this consultation (including around 20 women and 15 young people).

Consultation with the leadership of the women association of Sangabili (including Koulango and Lobi representatives)

Consultation with the leadership of the youth's association of Sangabili (including Koulango and Lobi representatives)

Sangabili, as well as a few other village communities in the region are already involved in the EWS through a mixed communication system that includes WhatsApp groups, community radios, and the active role of young people as "repeaters" of local language news through loudspeakers. According to the explicit requests that emerged from the consultation, it is crucial to strengthen the early warning system in place, by solving issues, such as the mobile phone and mobile network access suitable for accessing WhatsApp or traditional approach of dissemination of warnings. Even more important is to replicate and spread this system, whose effectiveness has already been proven in Sangabili, to the many other village communities affected by flood and drought. Awareness-raising and capacity-building activities, as well as the strengthening of grassroots associations (women's and youth associations above all) are indispensable in this regard. In Sangabili, thanks to VFDM, a community-based committee in Flood and Drought Management is up and running, which must be further supported to make it permanent. Similar committees should also be activated in as many villages as possible, also by enhancing the community-based realities already in place. It was also explicitly requested to strengthen and extend in time and space (including multiple other villages) some additional community-based flood and drought management actions aimed to increase the self-help capacities for flood and drought risk reduction, strengthen preparedness and enhance resilience, starting at individual household level, and spreading throughout to the entire community, including awareness-raising on how to mitigate flood and drought (which involves a change in mindset and a change in practical choices), training activities on how to manage the environment (e.g. the management of waterways and lowland, wetlands and their drainage), the planting of markers to signal stream growth in the event of flooding, simulation exercises; as well as activities for reforestation and to improve economic production/income-generating activities. Also, during the consultation in Badara and Pa communities of Burkina Faso, communities suggested to have simulation exercises which helps in understanding the effectiveness for dissemination of warnings and response measures to floods and drought.
During the final evaluation, based on discussions, there was a request to scale the VOLTALARM EWS to cover the national portion of the Volta Basin countries and further improvement in the existing flood and drought EWS with improved observation data, calibration of hydrological models and then covering other hazards (flash floods, urban floods) etc.

Also, during EW4All launch workshop in Ghana, more than 50 stakeholders from different agencies, International Organizations (IOs), NGOs and communities were consulted for understanding the current capacities, gaps and needs on the early warning systems and warning services for response or anticipatory actions.


Other key stakeholders were consulted in the framework of the current activities in the two countries of the Volta Basin especially in the preparation of the concept note of the VFDM Phase-2 project.
A new series of consultations are foreseen during the final proposal preparation phase to verify and validate the roles and responsibilities of the implementing entities, and to agree about the budget distribution and the work schedule within the project partners. An additional major activity to be conducted during the same period is related to the assessment of the potential social and environmental impacts of the proposed project activities aligning with the Environment, Social and Gender policies of the Adaptation Fund. The consultation will allow to reach the general population and communities by conducting semi-structured interviews, focus-group discussions or workshops during field visits, focusing on the minority groups, women, marginalized and vulnerable groups and indigenous people (selection of members will be through age, gender, social position and other aspects) prone to extreme hydrometeorological events and to the effect of climate change. The consultation process will provide information on acceptance of project activities by the communities and on their willingness to take roles and responsibilities in the Environment and Social Risk Management Plan (ESRMP). Special attention will be given to generate consensus from every stakeholder to allow active participation of women and other vulnerable groups in all proposed activities ensuring successful implementation and sustainability of the project.
The consultation will also provide the opportunity to get feed-back about the high-fidelity prototype of full scale integrated VOLTALARM MHEWS warning system envisaged by WMO and national partners. The proposed functionalities (language, type of information, forms of warning etc.) and benefits of the VOLTALARM service will be discussed with the participants so that their views, suggestions and needs will be acknowledged and incorporated in the final design and development of the web-based early warning system. Additionally, the consulted members can suggest further requirements or functionalities in the VOLTALARM to provide better sourcing, access and delivery of the early warning information to every section of the communities (potentially have a last-mile connectivity) prone to floods and drought.

J. Provide justification for funding requested, focusing on the full cost of adaptation reasoning.

Climate changes have been severely affecting the Volta Basin countries with regular and largescale floods and drought events especially impacting agriculture and ecosystems. The government of the two riparian countries are developing and implementing various strategies and action plans to be better prepared for these extreme events, with technical and financial support from partners and agencies.
The Adaptation Fund will support the Volta phase-II to expand on and complement existing projects (such as VFDM project), in accordance with the development priorities of the countries in the urban and rural areas. The first phase VFDM project implementation have increased Volta Basin region's community capabilities and their investments in socio-economic growth, such as houses, assets, livestock, food security etc. The proposed project will provide benefits to both communities and agencies of Côte d'Ivoire and Ghana (covering entire country) and opportunities to work in a coordinated and collaborated way achieving long-term adaptation measures for Flood and Drought management. The need for concrete adaptation measures to extreme events is an important requirement for the entire country according to the initial consultation by WMO with the stakeholders of the targeted countries. The Volta project includes the following components for developing adaptation measures and capacities:

Component 1: Enhanced understanding and access to data and information for informed-decision making, risk-based preparedness and adaptation to hydroclimatic variabilities.
Baseline situation (without any support from the Adaptation Fund)
In general, 80 percent of the land and natural resources in the Volta Basin region are prone to Floods and Drought events. The hydrological and meteorological characteristics of the Volta Basin and the projected climate change impacts on socio-economic vulnerabilities have not been adequately addressed and incorporated into development planning and other land use practices over the years. The government agencies of the targeted countries also lack adequate information about the increasing risks related to extreme events, resulting in improper planning and decision-making for flood and drought management. Therefore, private and community infrastructures and natural resources are continuously exposed to climate variability, resulting in damage and degradation of adaptive capacities.
Impact due to the proposed project (with the support of Adaptation Fund)
The Volta phase-II project plans detailed assessments of vulnerabilities, capacities and exposure to Floods and Drought events in the two countries and support in the development of the related risk maps and climate scenarios. Moreover, the project will help in the development of risk prevention and management framework and capacities of the stakeholders (especially policy-makers, disaster managers etc.) to take risk informed decision-making for Floods and Drought events. In addition, the project will bridge the gap in adaptation measures to integrate future scenarios (economic, urban, climate, environment, etc.) into current knowledge (risks mapping, hydrometeorological features) and practices to improve the future planning and design of concrete adaptation measures or interventions. For this purpose, synergies will be created between country level projects or programmes on climate change adaptation to develop integrated Flood and Drought management strategies and approaches at regional level. Additionally, local actors and flood prone communities lack knowledge and tools for mainstreaming Gender and developing natural and nature-based solutions for climate change adaptation, however they have useful traditional solutions and adhoc experiences which need to be captured and improved in new integrated Flood and Drought management strategies.

Component 2: Strengthening water resources management through access to hydro-meteorological information and augment regional /national capacity to monitor and assess Hydro-climatic hazards
Baseline situation (without any support from the Adaptation Fund)

Presently there is no systematic measurement practices appropriate for water resources, floods and Drought monitoring over a large part of Côte d'Ivoire and Ghana (at the exception of the VOLTALARM, White Volta and Oti basin which needs improvement in observations and impact-based forecasting). Some of the available instruments such as radars, sensors and gauges at the national scale are not functional or does not provide information for Flood and Drought forecasting and warning information to the communities prone to these hazards. The existing Flood and Drought preparedness and response measures are ineffective, due to the lack of technical capabilities of various national agencies working on Floods and Drought management. Without AF support, the situation will not change, or even deteriorate, and the population in the two Volta Basin riparian countries will continue to remain highly exposed to extreme weather, water and climate events and face consequent damages.

Impact due to the proposed project (with the support of Adaptation Fund)

The Volta project supported the development and implementation of VOLTALARM, an End-to End Transboundary Early Warning System for both Floods and Drought for the Volta Region (national portion which comes under the Volta Basin region) resulting in tailored hydrometeorological information services for the agencies, communities and the general public. The AF support will be used to strengthen data collection, transfer and management from the existing instruments on the Volta Basin and from external sources (global forecasting and platforms, remote sensing data etc.) to further improve the existing monitoring or forecasting products or to develop new products if not available under the flood and drought EW. This is a mandatory step towards a robust and appropriate network for impact-based forecasting and early warning information from current status, then from sub-seasonal to seasonal scale for risk informed decision making. The GIS-based early warning information system will be developed for the beneficiaries at all levels made of simple colour coded graphs and risks zoning, as proposed in the VOLTALARM. The EWS will improve the stakeholder's capacities to take decisions and prepare for reducing impacts and if required, implement alternative practices. These systems will be more efficient with improved coordination between the hydrometeorological services, the other concerned departments at local and national levels and the communities prone to floods and drought. The capacity development activities, such as gender mainstreaming for End-to-End Early Warning Systems for Floods and Integrated Flood and Drought Management through natural and nature-based solutions will help in developing pro-active approaches to account for climate change variability.

Component 3: Promote accessible national and regional decision support tools and coordination to enhance resilient and sustainable climate risk adaptation through long term investments from policies, plans and actions plans (INDC, NAP and NAPA)

Baseline situation (without any support from the Adaptation Fund)

Although the Volta Basin countries have recognized the need to adapt to climate change variability, the existing governance structure at the transboundary and national levels does not provide coordination and collaboration in water and natural resources management. The policies, guidelines or plans for collecting and sharing data and information related to hydrometeorological conditions are not yet enforced to improve preparedness for extreme events. The shortage of policies, plans and strategies at local, national and transboundary level for the management of short- to medium-term disaster risks exposes the Volta Basin population to non-sustainable socioeconomic conditions.

Impact due to the proposed project (with the support of Adaptation Fund) The AF support will allow to develop an enabling environment between local, national and international actors and stakeholders. Systematic coordination between two riparian countries will facilitate the achievement of the common objective to develop concrete risk reduction and climate adaptation measures. Additionally, the project will develop capacities of beneficiaries to review or develop new policy frameworks (NAPA, NDC 3.0 etc.) to integrate climate risks to land, water, environment, livelihood with development plans and practices at local, national and transboundary level on the Volta Basin.

The Volta Phase-2 project in Ghana and Côte d'Ivoire is designed to achieve all its proposed outcomes and outputs using solely the resources of the Adaptation Fund especially the key activities—such as development of national risk maps and impact based early warning systems, capacity-building at various levels, local cost effective and innovative adaptation measures in multiple communities/localities of 8 pilot testing sites under Table 9, and livelihood diversification based on short, medium and long term advisories from the NMHSs, strengthen governance frameworks by supporting the development, revision, and adoption of policies, regulations, and standards that mainstream resilience measures for climate change adaptation and disaster risk reduction into national development plans, etc. The proposed achievements will be delivered using the existing resources, tools and capacities available from the Volta phase-I project as well as building synergies and complementarities with other on-going and completed projects provided under section II.G in the two targeted countries. The implementation of the community-based flood and drought management including the local climate change adaptation measures will be covered in 20-25 vulnerable communities. Based on the experiences and lesson learned, the local and national government will be provided with tools and guidelines to continue implementation of similar activities in other communities where similar needs and interventions are required.

K. Describe how the sustainability of the project/programme outcomes has been taken into account when designing the project/programme.

The proposed VFDM project phase-II sustainability will be achieved through strengthened local and national ownership of project activities and enhanced national and regional technical capacities through close collaboration with stakeholders at all levels ensuring their long-term commitments for climate change adaptation efforts. The project will seek to integrate the technological capacities of available flood and drought warning systems alongside ongoing national and regional initiatives. More so, the project outcomes are aligned with the national policies and frameworks. National Agencies are supportive of the project (attached here are the Support and commitment letters from SODEXAM and GMet) and have shared the commitment and sustainability letters for the VFDM project outputs and outcomes. Regional entity ECOWAS and VBA will be invited to coordinate and join the regional level activities to support the countries in maintaining the products, tools or guidelines developed under the project and to be scaled up in other countries of the West Africa.

The expansion of the initiative beyond the Volta Basin region to cover entire countries as shown under Figure 15 and Table 20 will be guided by lessons learned from the initial phase, ensuring that best practices are scaled up and institutionalized. A bottom-up approach will be emphasized to understand the risk and adaptation gaps of vulnerable populations to ensure needs are addressed and facilitate risk-informed decision-making process. Sustainability will be reinforced through capacity-building initiatives targeting national and local institutions responsible for water resource management, disaster risk reduction, and early warning systems. Training programs will enhance technical expertise and operational capacity, ensuring that project interventions are effectively managed beyond the project's lifespan. The wide curriculum of trainings covering aspects ranging from hazard and risk mapping, water balance, hydrological outlooks, community-based flood management, roving seminars for farmers on agro-meteorology, integrated drought management to End-to-End Early Warning Systems for flood management etc. will provide technical support and new decision-support tools for the national/regional operational centres. The project will also focus on policy integration, aligning activities with national climate adaptation plans, water resource management strategies, and disaster risk reduction frameworks. This alignment

will facilitate long-term government commitment and resource allocation. Additionally, multi-stakeholder engagement, including communities, private sector actors, and civil society, will create broad-based support and encourage co-financing opportunities to sustain project benefits. Finally, by leveraging regional partnerships and fostering cooperation between the participating countries, the project will establish mechanisms for long-term coordination, data exchange, and joint decision-making. Strengthening the role of national and regional institutions in managing climate risks will ensure that the benefits of the project continue to serve vulnerable populations beyond its implementation phase.

For the outcomes of component 1: Long term sustainability will be developed by facilitating participatory stakeholder engagement and knowledge exchange between local communities and government agencies. By showing if, how and when, the risks for Floods and Drought events will change over short and longer periods in the Volta basin, the stakeholders will become aware of the value of the vulnerability, capacity, exposure and risks assessment activities, the related alteration of the risk factors for Floods and Drought and their impact on their daily life. Hence, the periodical assessment of the VCERs will need to be developed by the national agencies to update the associated Flood and Drought risk maps of their communities in order to be prepared for climate related extreme events. Local communities will, therefore, be incentivized to continue implementing and maintaining the various outputs under component 1 upon which their lives and livelihoods depend. This will encourage project sustainability at both the community and government/agencies levels.

For the outcomes of component 2: Long term maintenance of the tools and methodologies for the activities under component 2 will be sought through commitment of the countries to provide sufficient resources for the sustainability of the new system. WMO will build on lasting collaborations with the Volta basin countries, as the pilot project AOC-HYCOS and the subsequent Volta-HYCOS, VFDM projects etc. The Multi Hazard forecasting and Early Warning Systems (EWS) for Floods and Drought, as envisaged in the VOLTALARM, will be developed and used by the actors of national agencies, especially the representatives of NMHSs and national disaster management authorities. The long-term share of duties and responsibilities for the MHEWS will be taken up by the NMHSs, with support at governmental level in the Ministries. Additional institutions involvement will be discussed during the capacity development activities of all components. In the future, APFM will provide technical assistance to the countries agencies to develop bankable project proposals to get funding for local projects in particular for the implementation of the natural and nature-based solutions for Floods. The Economic Community of West African States (ECOWAS) Disaster Risk Reduction (DRR) Strategy (2015-2030) will provide a guiding framework for scaling up early warning and response systems. In Ghana and Côte d'Ivoire, the project will align with the national Multi-Hazard Early Warning Systems (MHEWS) frameworks emphasizing early warning systems as key climate resilience measures.

For the outcomes of component 3: The involvement of national agencies and regional authorities/agencies is extremely valuable to ensure the temporal dimension of component 3, and specifically the sustainability and long-term effects of data sharing policies, sustainable development plans and practices and code of conducts at the local, national and transboundary scales. NMSs will increase its operational role and maintain the project results on the longer term, therefore contributing to the
implementation of the National Adaptation Plan and Volta basin Strategic Action Programme (SAP). Major institutions in charge of coordination and civil defence activities from national to local level will be integrated while detailing, and later implementing, the project components: such as for example NADMO and the Water Resource Commission in Ghana and Civil Protection and water Resources agencies in Côte d'Ivoire. They all will integrate some of the innovation and methodologies of the Volta phase-II project into their procedures after contributing to the training and operational activities.

Private companies or stakeholders (dam operators, telecommunication, agriculture based etc.) will be involved in the implementation of activities such as design and use of the EWS, data and information of infrastructures for developing risk maps, community based activities, policies etc. benefiting from the project outputs as well as contributing with ta

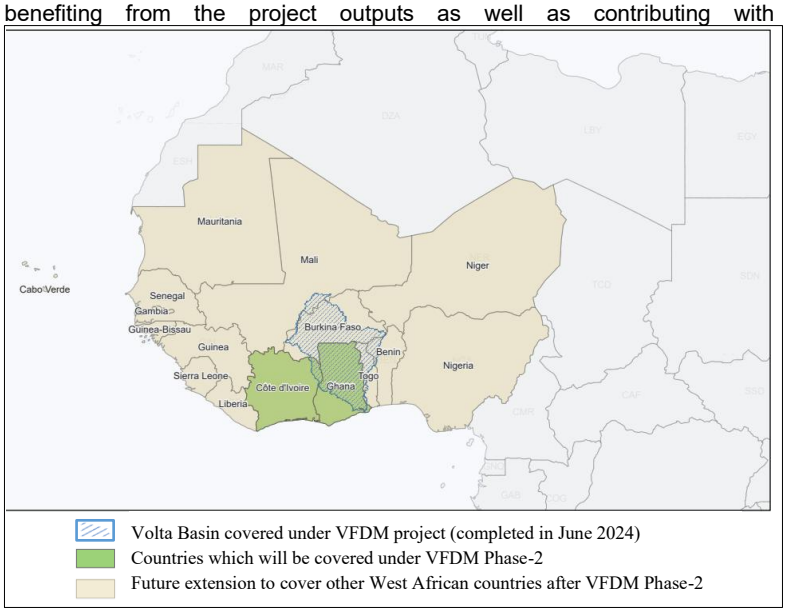


Figure 15 Future extension of the VFDM outcomes across West Africa

To ensure the long-term viability and impact of Volta Project Phase II, several avenues for sustained financing have been explored and are being actively developed:

Long-Term Budgeting: The project is being integrated into relevant national and regional development frameworks, with provisions made for its inclusion in long-term public sector budgets through national policies and development planning. This alignment supports continued financing of core activities beyond the project lifespan.

Endowment Funds: Preliminary steps have been taken toward the establishment of an endowment mechanism (government yearly budget to NMHSs), with the aim of generating a reliable source of funding to support future operations, maintenance, and capacity-building needs of communities and institutions engaged in the project.

Public-Private Partnerships (PPPs): The project has identified strategic opportunities for leveraging private sector engagement, particularly in areas such as sustainable land management, water infrastructure (dam operators, tele communication, transport etc.), and climate-smart technologies (insurance companies, private agriculture-based companies etc).

These partnerships are expected to provide both financial and technical contributions to enhance the project's resilience and scalability.

These measures collectively demonstrate a commitment to financial sustainability and are aligned with the Adaptation Fund's goal of ensuring that funded initiatives deliver lasting adaptation benefits for vulnerable communities.

Scaling from VFDM Phase 1 to Phase 2

Table 20 The below table highlights the scaling topics and interventions from VFDM-Phase 1 to VFDM-Phase 2, aligned with the overall objective

Topics description	VFDM – Phase 1 (2019–2024)	VFDM – Phase 2 (2026–2029)
Project Geographic Coverage	Pilot areas which come under the Volta Basin portion of Cote d'Ivoire and Ghana	National coverage in Cote d'Ivoire and Ghana
Early Warning Systems (EWS)	VOLTALARM developed for the Volta Basin portion of Cote d'Ivoire and Ghana and piloted at local level	VOLTALARM scaled up to cover entire national level, integrated with national DRR platforms Integration of hydrological forecasting over longer time scales (seasonal to sub-seasonal) for water resources planning
Climate Risk Information	Initial risk maps and climate projections for only Volta Basin portion of Cote d'Ivoire and Ghana	Updated and expanded risk maps and projections for entire Cote d'Ivoire and Ghana for national and local planning
Institutional Engagement	Coordination mostly among national institutions and basin-level authorities	Strengthened national and local institutions coordination and policies aligned with local, national and regional strategies
Community-Based Adaptation (CBA)	Pilot CBA interventions in selected two communities under the Volta Basin portion of Cote d'Ivoire and Ghana	Scaling of CBA practices to vulnerable communities (more than 20 communities) across both countries
Policy & Planning Support	Draft regional and national strategy developed and adopted	Finalized regional flood and drought strategy and plans implemented and 5-year national implementation action plan for Cote d'Ivoire and Ghana with national and international investments
Stakeholder Collaboration	Engagement with core national and regional stakeholders	Broader multi-stakeholder collaboration, including private sector and CBOs
Capacity Building	Training of technical personnel from national and local actors in selected zones under the Volta Basin portion of Cote d'Ivoire and Ghana	Institutionalized capacity-building programs at national and local levels in entire Cote d'Ivoire and Ghana

The methodologies adopted and trained resources (both agencies and communities) through the project are expected to be a support for other actors and stakeholders in developing floods and drought risks maps, climate change scenarios and GIS-based early warning system of their respective countries (regions outside of the Volta Basin). Furthermore, through the collaborative process with external entities, including among others OSS, other Basin Authorities, economic commissions, international organizations etc. the Volta project results, experiences and success stories will be further disseminated into the whole West African region, as illustrated in the figure above.

L. Provide an overview of the environmental and social impacts and risks identified as being relevant to the project/programme.

In accordance with the Adaptation Fund's Environmental and Social Policy and through initial screening in consultation with the country stakeholders, the proposed project can be classified as Category B, indicating that some activities may lead to potential environmental or social impacts that are limited in scale, site-specific, reversible and can be readily mitigated. Most of the activities proposed under the Volta Phase-2 are non-structural measures such as development of risk maps, EWS, community-based flood and drought management including climate change adaptation measures such as nature-based solutions, adaptation to crops based on availability of water etc. and will not lead to any social and environmental risks. However, the proposed project output such as the awareness on developed risk maps can alert the national agencies and communities about locations possibly at-risk for flood or drought events where already communities are residing. The national agencies might then consider moving or relocating people, or people on their own could decide to move to safer places in urban or rural areas. This can be considered as primary indirect risks. Moreover, secondary or dependent risks such as economic marginalization, fight for water, land and food resources and social and cultural conflicts with the existing people at the new location might become a challenge to the relocating families. The proposed project will raise awareness or knowledge for such risks and potential safeguard measures with prior and informed consent of the stakeholders. A detailed EIA and SIA study in the next proposal development phase is planned to allow screening of all 15 AF environmental and social principles including gender policies. An Environmental and Social Management Plan (ESMP) will be developed and will be used in case of any triggering of risks identified during regular monitoring of the implementation.

All the 15 principles of the AF environment and social policies will be screened again during the ESIA study planned in the proposal development stage and the below table 21 will be updated.

Table 21 VFDM Phase-2 environmental and social impacts and risks identified

Checklist of environmental and social principles	No further assessment required for compliance	Potential impacts and risks – further assessment and management required for compliance
Compliance with the Law		Risks: Very Low Impact: Low No compliance-related risks are foreseen, as the project will work closely with national and local stakeholders throughout the planning and implementation stages to ensure thorough screening of land and resource rights, regulatory permits, data use, accountability, and human rights obligations and laws. The project will ensure that the existing local, national and transboundary laws, policies and guidelines of Volta Basin countries will be followed during the implementation of adaptation measures or in capacity development activities. If required international laws on data sharing protocol among different countries will be consulted. During the design of the project especially component 3.1: both regional and national stakeholders will be consulted to update data sharing protocol/laws between the two countries.

		However, for the installation or rehabilitation of the hydrological and meteorological stations or warning systems at local levels, screening of laws or acts will be carried out to adhere to the requirements necessary for the safe installation and protection of infrastructures. Risk Mitigation and management measures: Before implementation of any activity, concept note, or Terms of Reference (ToR) will be shared with the stakeholders to check if there is any non-compliance with any laws, acts and policies. Following the agreement with the local, national and regional stakeholders, implementation of the activities will be carried out. In case of any potential risks and impacts are identified during the implementation phase, risks prevention or management strategies will be defined and executed as per the ESMP (planned to be developed during the proposal development phase) This will be further assessed during the ESIA study.
Access and Equity		Risks: Low Impact: Low No potential risks are foreseen under 'Access and Equity,' as the project will ensure inclusive participation and equitable benefits for all community members. The project will provide impartial and equitable access to benefits from the implementation of the project. The project design is developed to allow representative of vulnerable groups in every capacity development trainings/workshops. The selected participants are expected to disseminate the training knowledge to other members of communities or organisations so that everyone will have fair and equitable access to all project benefits. The selection of beneficiaries will also be made in consultation with local practices, traditions and access to social facilities. However, the project has capacity development activities to which only few members of the communities will be able to participate. This will be informed to the stakeholders to avoid mis communication and develop a plan for sharing of knowledge from engaged participants to others who were not able to participate. This will be further assessed during the ESIA study.
Marginalized and Vulnerable Groups		Risks: Low Impact: Low The project will contribute to the reduction of existing inequalities for EWS for floods and drought, particularly those affecting marginalized or vulnerable groups dependent on agriculture or living in urban areas. The EWS system for floods and drought will be available through technological sources. The members of communities and local agencies will be provided with adequate knowledge and explanations about the systems to use it for their own benefits. There is a risk that vulnerable and marginalized groups will have insufficient knowledge and access to technological devices such as mobile phones or lack of good cellular connectivity specially required for component 2 of the proposed activities. To avoid the exclusion of marginalized and vulnerable communities, traditional practices will be implemented to reach these groups especially women, girls, elderly, physically challenged individuals. Initial risk mitigation and management measures: Through participatory approaches, the project will ensure community focal points and representatives are consulted during planning to understand the issues, gaps and needs of marginalized and vulnerable so that solutions are identified and implemented with their consent. Traditional practices such as community gatherings, use of local leaders, public announcements, and other culturally appropriate methods will be utilized to disseminate information and warnings. In addition, awareness-raising and capacity-building activities will be tailored to the needs of marginalized and vulnerable groups to ensure they can access, understand, and act upon early warning messages. This approach will safeguard equity and inclusiveness, ensuring that no one is left behind in disaster preparedness and response. This will be further assessed during the ESIA study.
Human Rights		Risks: Very Low Impact: Low No potential risks have been foreseen as the proposed activities are or will not be against any of the established international human rights. Moreover, the proposed project will promote the basic human rights of access to water, food and information. The project will provide opportunity for every individual to give their views, perceptions and needs in developing better climate change adaptation measures. However, there is a possibility of participation of only specific groups of people in the capacity development activities due to the prior involvement or consultation, authoritative personality and access to the location, availability and language barriers. Risk Mitigation and Management measures Before implementation of any activity, concept note, or Terms of Reference (ToR) will be shared with the stakeholders to check for he potential participants from all groups to join the project activities. As much as

		possible, participation of the stakeholders from all the groups will be prioritized in the project activities. Sharing of experiences and knowledge from the beneficiaries to other stakeholders will be prioritized. This will be further assessed during the ESIA study.
Gender Equity and Women's Empowerment		Risks: Low Impact: Low The proposed project will improve the gender equity and women empowerment through the WMO developed tool: Training Manual for mainstreaming gender in End-to-End Early Warning system for Floods and integrated Flood Management through a participatory design approach. This will help in increasing the participation of women, girls and other vulnerable groups in Flood and Drought management activities as well as decision making processes. The proposed project is targeting region where men occupy the majority of the leadership positions. Women participation to disaster preparedness and decision making is often limited due to cultural and social norms. There is therefore a risk that women will not benefit equitably from the proposed adaptation measures and capacity-development interventions. Initial risk mitigation and management measures: To avoid potential risks and impacts on gender equity and women's empowerment, the project will actively ensure the full participation of women in planning, decision-making, and implementation processes. Specific measures will be taken to guarantee that women have equal access to project benefits, training, and resources. Gender-sensitive approaches, such as scheduling activities at times convenient for women, providing safe spaces for engagement, and using communication methods that reach women effectively, will be integrated. The project will also promote women's leadership roles within community-based activities and support their capacity-building to strengthen resilience against floods and droughts. By adopting these proactive measures, the project will not only avoid risks of exclusion but also contribute to advancing women's empowerment and equitable outcomes. Learning from previous projects at national and regional levels on similar project thematic areas will be reviewed to learn the approaches adopted in mitigating or managing any risks. This will be further assessed during the ESIA study.
Core Labour Rights		Risks: Very low Impact: Low Based on initial screening, no potential risks are foreseen for 'Core Labour Rights,' as the project will fully comply with national labour laws and international labour standards, ensuring fair and safe working conditions for all participants. The project will be implemented and managed in compliance with the countries designated labour laws. No individual will be hired without pay and the payment will be according to the countries labour legislation/laws. Child labour will be forbidden, and it will not be accepted from other project partner agencies. Local communities will be involved in the adaptation measures but will not be exposed to any risk of accidents. Core labour rights will be respected and considered in project design and implementation. However, during hiring of national and local experts for development of the risk maps, EWS and other measures, preference might be given to male candidates due to limited scientific knowledge and experience (related to Hydrology and Meteorology) in the female candidates of the two countries. This will be further assessed during the ESIA study.
Indigenous Peoples		Risks: Low Impact: Low The indigenous population in the region will be consulted and involved during the design and implementation of the project activities. The traditional knowledge of indigenous people on Flood and Drought will be useful when preparing the risk maps, the early warnings and information dissemination. There is a risk that the traditional use of water resources, irrigation system and land use pattern will be challenged. Therefore, a detailed analysis will be carried out by local and national agencies to understand the use of natural resources especially regarding to water and land use. Initial risk mitigation and management measures: Learning from previous projects on similar thematic areas will be reviewed to learn the approaches adopted in mitigating and management of any risks. Although continuous consultation with Indigenous communities will be maintained throughout the planning and implementation phases to ensure their perspectives, needs, and rights are fully considered, thereby avoiding any negative impacts and supporting culturally appropriate and sustainable outcomes This will be further assessed during the ESIA study
Involuntary Resettlement		Risks: Low Impact: Medium There are no direct activities proposed in the project which will create direct involuntary resettlement of communities. However, there might be in-direct risks for involuntary resettlement after the development

		of risk maps which shows some of the residential areas in the floods and drought hazardous zones. Following this, communities might be relocated to safer areas but there might be some social (integration with new communities) and economic (search for livelihood options) and cultural impacts (following of local practices and norms etc.) to the relocated population. Initial risk mitigation and management measures: The project will ensure that any relocation process is carried out in close consultation with affected communities, respecting the principles of free, prior, and informed consent. A participatory approach will be adopted to identify alternative livelihood opportunities, support social integration, and safeguard cultural practices. Where required, national and local authorities will be engaged to provide legal safeguards, compensation, and social support mechanisms, ensuring that resettlement, if unavoidable, is voluntary, inclusive, and culturally sensitive. This will be further evaluated during the ESIA study.
Protection of Natural Habitats	X	Risks: Very Low Impact: Low There are no potential direct risks to the protection of ecosystems and its natural habitats and biological diversity through the programme activities. Natural and nature-based solutions will be promoted using the Flood Green Guide through International partners such as WWF and IUCN. In case of NBSs implementation, a detailed ecological assessment will be conducted before implementation.
Conservation of Biological Diversity	X	Risks: Very Low Impact: Low No potential risks are foreseen as there will be no direct risks associated with the conservation of biological diversity. The project will support in conservation of biodiversity through development of EWS which will protect biodiversity by minimizing human pressure (e.g., panic deforestation or hunting during drought/famine) and risk maps identifying ecologically sensitive zones (wetlands, mangroves, wildlife corridors) and will support in land-use planning to avoid development in biodiversity-rich or fragile habitats.
Climate Change	X	Risks: Very Low Impact: Low No potential risks are foreseen as the project does not only increase the flood and drought adaptation capacity and resilience of the local population but also contributes to develop better governance structure, policies and plan at both national and regional level for climate change adaptation. There is no activity which will release CO2 emission and lead to climate change.
Pollution Prevention and Resource Efficiency	X	Risks: Very Low Impact: Low No potential risks are foreseen as the proposed project activities are not expected to result in water, air and soil pollution.
Public Health	X	Risks: Very Low Impact: Low No potential risks are foreseen as the project activities should not have negative effect on public health. On the contrary, it will contribute to prevent the population from natural disasters, to improve income for getting access to health facilities, etc. This will be further evaluated during the ESIA study.
Physical and Cultural Heritage	X	Risks: Very Low Impact: Low No potential risks are foreseen as the project does not have any activity related to affecting physical and cultural heritages. The significance of the project is to develop better management of water resources and have traditional and cultural integration among the individuals.
Lands and Soil Conservation	X	Risks: Very Low Impact: Low No potential risks are foreseen for 'Lands and Soil Conservation as the EWS and risk mapping are primarily information and planning tools, which do not involve physical alteration of the land. Nature-based solutions—such as wetland restoration, reforestation, and watershed management—actually improve soil stability, reduce erosion, and enhance land productivity. Community-based activities focus on sustainable land and water management practices, ensuring that soil and land resources are preserved rather than degraded. Therefore, the project inherently supports soil conservation while mitigating flood and drought risks.project will promote the conservation of soil and land resources, especially through the selection of natural and nature-based solution with environmental-friendly solutions.

PART III: IMPLEMENTATION ARRANGEMENTS

A. Describe the arrangements for project management at the regional and national level, including coordination arrangements within countries and among them. Describe how the potential to partner with national institutions, and when possible, national implementing entities (NIEs), has been considered, and included in the management arrangements.

As per the Institutional Arrangement of the VFDM phase-2 project as shown under Figure 16, WMO will be the implementing and executing entity with Société d'exploitation et de développement aéroportuaire, aéronautique et météorologique (SODEXAM) and Ghana Meteorological Agency

(GMet) for the project providing overall management, procurement services and specific technical support in the execution of the activities. Its international experience and presence through their WMO Regional Office for Africa (in Abuja), situates it ideally for coordinating with national authorities, especially NMHSs (other executing entities of the project). The Technical Support Unit (TSU) of the WMO Associated Programme on Flood Management (APFM) and the Integrated Drought Management Programme (IDMP) supported by a network of Support Base Partners comprising of NMHSs, academia or research centers, private engineering companies and internationals organizations will design and develop technical solutions with the executing partners (WMO, Société d'exploitation et de développement aéroportuaire, aéronautique et météorologique (SODEXAM) and Ghana Meteorological Agency (GMet)) and they will have close links with the beneficiaries in the field. The WMO jointly with other EEs (Société d'exploitation et de développement aéroportuaire, aéronautique et météorologique (SODEXAM) and Ghana Meteorological Agency (GMet)) will select the APFM and IDMP technical implementation partners (to support the national agencies in implementing various activities) ensuring the following 1) Organizations have experience of working in the project countries or region 2) Organizations have relevant technical expertise in the various areas of project activities ensuring solutions and tools are provided that are free and open source following participatory approach which will be sustainable and without leading to social, environmental and gender related risks. Considering the existing capacities of the NMHSs and mandate of working and supported by the WMO, it is important that WMO provide technical execution support to the NMHSs so as to develop affordable, tailored and sustainable solutions following WMO standards, guidelines and practices in the project countries. Other WMO teams (members of Standing Committee on Hydrology, Disaster Risk reduction and Agriculture) will provide support in reviewing the project results and programmes. The HydroSOS team comprising of WMO hydrological coordination staff, UK Centre for Ecology & Hydrology(UK-CEH) and other contributing partners will be instrumental in providing technical guidance and implementation support to the national agencies. Other on-going initiatives of the WMO Climate Risk and Early warning system (CREWS), HydroHub programme, Dynamic Water Assessment Tool (DWAT) will contribute to the development of tools, products and services delivery to the decision makers and also expand the results of the project to the neighboring regions.

At the regional level, ECOWAS, VBA and WASCAL will lead the co-regional cooperation and coordination of the activities jointly working with the WMO, NMHSs, and partners of the two countries (support letter is provided here). The involvement of the regional entities will allow the project to link and use the existing activities/information in the two countries building synergies and complementarities with the proposed VFDM phase-2 project.

At the National level, Société d'exploitation et de développement aéroportuaire, aéronautique et météorologique (SODEXAM) and Ghana Meteorological Agency (GMet) as executing partners will lead the planning, execution, monitoring, and reporting with NIPs, facilitate communication between local communities, government agencies, and implementing partners, and ensure alignment with legal, environmental, and social safeguards. WMO will collaborate with NMHSs of two riparian countries of Volta Basin to lead the technical implementation and coordination of the project activities. For executing the project activities, Société d'exploitation et de développement aéroportuaire, aéronautique et météorologique (SODEXAM) and Ghana Meteorological Agency (GMet) (through a project officer) will be the National focal point and will implement the technical activities at the National and local levels through local agencies, NGOs and private partners forming a network of technical support group. Société d'exploitation et de développement aéroportuaire, aéronautique et météorologique (SODEXAM) and Ghana Meteorological Agency (GMet) will be in-charge of engaging and disseminating the project results towards the National Implementing Partners (NIPs) (related Ministries and agencies in charge of Water Resources, Environment, Hydropower, Irrigation, Agriculture and Civil Defense), and to the regional organizations such ECOWAS, AGHRYMET, WASCAL, VBA etc. working at the basin or regional levels. The National agencies of the Volta Basin countries will come together to define the regional implementation plan and strategies for the long-term sustainability of the project outputs and outcomes.

A project steering/advisory committee will be established with membership of National designated authority, agencies specialized in hydrology, meteorology, water resources, disaster management and of regional entities which will provide review and strategic guidance to the implementation of the project activities as well as support in promoting the project results in the region or outside the Volta Basin countries. The proposed project will take into consideration the existing information, resources and infrastructures available in the country and try to support the needs of the Volta Basin countries to develop MHEWS with HydroSOS system as well as support in developing concrete adaptation measures for climate change resilience at local and national levels. For each of the two countries, the contributing national and local partners related support (knowledge and skills) will be gathered and used for developing tools and products. They will play an important role in the implementation of the activities and working with the local stakeholders and beneficiaries. The list of the national agencies responsible for each activity will be refined before the inception meeting. A detailed project implementation arrangement is described in the figure above showing how implementing, executing and other national entities coordinate and report to each other. During the next phase of the project development, a clear description of the roles and responsibilities of the implementing entity and of executing entity or organizations/stakeholders involved in the project will be provided. For coordination at all levels, a regional working strategy group (RWSG) (mainly to check the implementation progress of the activities, engage in policy dialogues and knowledge exchange, facilitate cooperation, and develop advocacy and joint strategies for dissemination at global platforms) and National Working Group (NWG) (supported by the appointed National Project Officer of the Executing Entities) will be established in each country and will be responsible for the overall execution of the project and facilitating coordination with various stakeholders including IE and EEs of the project. The IE and EEs will provide overall guidance, assessing implementation progress with the intended objective and technical support during the

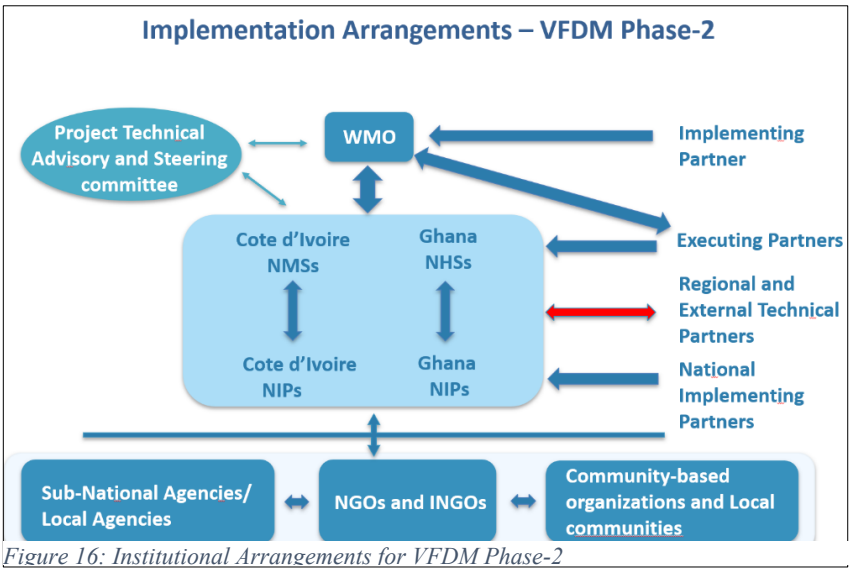


Figure 16: Institutional Arrangements for VFDM Phase-2

implementation of the project activities. During the next phase of the project development, implementation cooperation and arrangements will be refined with additional stakeholders from global, regional, national, and local levels. A Project Management Unit (PMU) will be established with the WMO, Société d'exploitation et de développement aéroportuaire, aéronautique et météorologique (SODEXAM) and Ghana Meteorological Agency (GMet) staff working directly with the regional working strategy group (RWSG) and National Working groups (formed with the representatives of various agencies) to ensure the planning and timely execution of the project activities.

Roles and Responsibilities of the implementing, and executing partners, national and regional technical coordination partners, and external technical partners

Roles and Responsibility of the Implementing and Executing Partner (WMO)

- Responsible for the overall management of the project, including all financial, monitoring, and reporting responsibilities
- Funds transfer to the executing entities
- Implementation of various activities through the support of regional, national, and international technical partners ensuring solutions are services provided are affordable, tailored, and sustainable.
- Procurement of goods and services (including consultants)
- Follow Adaptation Fund environment and social policies in the planning and implementation of the project activities
- Lead the development and submission of the annual project progress report (PPR) and share it with the adaptation fund for review and endorsement
- Conduct independent mid-term and final evaluation

Roles and responsibilities of the other Executing Entities (Société d'exploitation et de développement aéroportuaire, aéronautique et météorologique SODEXAM and Ghana Meteorological Agency (GMet)**)**

- The executing entities are fully accountable for the management, operation, and use of funds for activities at the national and local levels
- Executing entities will carry out specific tasks related to the preparation and execution of adaptation activities in joint support of other NIPs
- Support Implementing entity in various activities: M&E reporting and procurement services (including consultancy) through local NGOs and partners based on the needs
- Support and develop technical and financial reports of the activities and PPR reports and submit it to the Implementing Partner

The responsibilities and duties of the Internal and External technical partners shall be the following:

- Provide technical design support and develop solutions requested by the Implementing and Executing partners
- Help implement activities at the Local, National and Regional level
- Ensure linkage with the completed, on-going, and upcoming projects or initiatives

The PMU will be comprised of the following focal points:

1. WMO Project Manager
2. Two Project Officer - Côte d'Ivoire
3. Two Project Officer – Ghana

The PMU will be headed by the Project Executive of the WMO (representative of the Implementing Partner) who will have the overall responsibility of the project and will have regular consultations with the representative of the Executive Partners.

Responsibilities of the PMU

- Day to day planning and implementing the project activities;
- Building synergies and complementarities with other completed and on-going initiatives
- Develop project work plans and associated budgetary provisions.
- Drafting of regular progress reports.
- Ensuring joint coordination, sharing of work plans, quality assurance of activities and outputs.
- Jointly promote and ensure visibility of the project, through issuance of communication products as may be appropriate.
- To identify and resolve potential situations of conflict or challenges that may negatively impact on the project implementation.

B. Describe the measures for financial and project / programme risk management.

Financial and project risks measures will be assessed as an on-going process throughout the design and development of the project. The initial potential risks identified are identified as below under Table 22:

Table 22 VFDM Phase-2 Financial and project risks identified

Type of risk and how it affects the project	**Risk impact on the project goal** (Low, medium, high)	**Probability of occurrence** (low, medium, high)	**Mitigation measure(s)**
Social Even though detailed needs assessments and consultations with stakeholders have been conducted since 2019 until 2024, the support of the stakeholders can differ in the targeted countries. This will result in differential levels of acceptance or support and eventually could slow down the inception phase of the project.	Medium	Low	- During the preparation phase of the project, all relevant stakeholders (government, agencies, departments and communities) will be/are clearly identified, so that they fully share the vision and goal of the project and are aware of their contribution to the project, hence fostering ownership and sustainability over the process. - MoU or agreements will be signed with the participating stakeholders. -Roles and responsibilities of the implementing/executing agencies and other technical agencies/organizations will be defined in the initial stages of the project so that all the activities are completed in a coordinated way.

Type of risk and how it affects the project	Risk impact on the project goal (Low, medium, high)	Probability of occurrence (low, medium, high)	Mitigation measure(s)
Institutional Administrative barriers hinder sharing of hydro-meteorological, social and topographic data. This result in difficulties to implement components 1 and 2.	Medium	Medium	The implementing (WMO) and executing (NMHSs) entities will ensure the required data and information are made available and national level tools and products are shared. Furthermore, WMO is mandated for national and regional exchange of data and information on hydrology, meteorology and climatology and can request the enforcement of the agreements.
Institutional Component 2 of the project is too technical and not adapted to specific area or countries. This might result in low commitment and interest from stakeholders	Medium	Low	The project activities will be first reviewed by experts of WMO and NMHSs and eventually with the support of NIPs, local decision-makers and participants from community, the available resources, expectations and suggestions will be collected. The feedback and suggestions from the participants will be integrated into the planning and implementation of the activities.
Political Restructuring in the government work structure may cause possible shifts of responsible persons at local and national levels to a different location. This can result in delays and loss of support.	Low	Medium	Alternative persons from the departments will be involved in most of the activities so that implementation of project activities will not be hampered at any time.
Financial ▪ Inadequacy of the financial management system: procurement system, financial availability, monitoring, reporting and auditing system, etc. ▪ Availability of project resources ▪ This will result in slowing down the project activities	Low	Low	During implementation, project and financial monitoring/reviews will be conducted to ensure efficient management of project resources.
Institutional: Lack of skills or human resources availability ▪ Adequacy between existing and required experience and skills ▪ This results in slowing down the project activities	Medium	Low	-The project benefits from the deployment of professionals/staffs by the implementing and executing agencies (WMO/NMHSs) who are selected by a panel of experts. Their ToRs are developed based on the project needs and in collaboration with the hosting institutions. - National support is obtained at the level of the governmental agencies to ensure sufficient human resources
Institutional ▪ Lack of available tools and templates for developing reports and progress report ▪ Delays of reporting by the partners ▪ This results in delays in the reporting process and access to funding	Low	Medium	Appropriate tools/templates and reporting structures and procedures will be put in place by WMO to ensure proper documentation and reporting so that donor agencies and steering committee receive timely reports.
Political Interference from the local/national political parties. This will result in delaying the project activities	Low	Low	The project will adhere to the goals, laws, and policies of the respective GBM countries. Whenever and wherever required, permission of national consensus of the countries will be taken or shown.
Social: Gender neutral approach Techniques and technological tools developed are not accepted by all groups of the communities. This decreases the gender inclusive or equality compliances	Low	Medium	The project includes gender sensitive approach in all activities. Wherever required non-technological or traditional methods will be adopted to reach and get participation from every group of the communities.
Environmental: Considering Cote d'Ivoire and Ghana are prone to yearly flooding and drought situations, it could lead to delay in the implementation of activities such as community-based activities, capacity development etc. due to unavailability of stakeholders	Medium	Medium	Sub-Seasonal and Seasonal weather outlook will be monitored to plan the implementation of the activities including agriculture seasons so as to ensure adequate participation of the stakeholders.

WMO Monitoring Evaluation and Risk Prevention (MERP) team and its technical advisory group (Standing Committee of Hydrology and working groups) will provide support to the project team and executing agency for conducting regular risk monitoring and evaluation of the project activities, and the results will be tracked and reported in WMO's internal monitoring system as well as to the Adaptation Fund through Annual Project Progress reports. In addition to this, a dedicated Monitoring and Evaluation (M&E) team will be formed, to ensure essential budget and resources are allocated to execute the M&E framework including mid-term and terminal evaluation.

C. Describe the measures for environmental and social risk management, in line with the Environmental and Social Policy of the Adaptation Fund.

In the final preparation (proposal development) phase, an Environmental Impact Assessment (EIA) and Social Impact Assessment (SIA) study (in line with the Environmental, Social, and Gender Policies of the Adaptation Fund) will be conducted for screening the proposed project activities against the 15 principles of the Environmental and Social Policy of the Adaptation Fund as well as national laws or standards related to the overall project goals and objective. The EIA and SIA study of the project will be undertaken by two ESIA national experts taking to account the existing laws, legislation or practices in place of Côte d'Ivoire and Ghana countries, along with the transboundary laws and acts on Environment and Social including Gender aspects.

The national experts/ consultants having more than 10 years of experience will be hired to conduct environmental and Social Impact assessments in the targeted regions. The methodology of the study includes field visits to the vulnerable locations of two countries, semi-structured interviews or focus-group discussions with the agencies (national meteorological and hydrological services (NMHSs), disaster management, environment, water resources, and irrigation, civil authorities, etc.) and citizens (representatives of communities impacted by floods and droughts, marginalized and vulnerable communities, community-based organizations, associations or self-help groups, etc.).

Based on VFDM phase-I implementation and initial discussions with the stakeholders (before submission of the concept note) in the two countries highlighted the minimal direct risks associated with the implementation of the proposed activities at the regional, national, and local levels with higher positive impacts. According to the Adaptation Fund's classification, this project is expected to be Category C and will not have direct negative environmental or social impacts. The necessary detailed studies will be carried out in the next phase of the project development process to ensure compliance with the environmental and social policies and principles of the Adaptation Fund. Where appropriate, an environmental and social risk management plan aligned with the Adaptation Fund requirements would be developed. During project implementation, the environmental and social risk management plan would be disseminated to stakeholders, with a view to adopting appropriate measures to mitigate adverse effects of project activities, if any. A grievance mechanism would then be provided to address potential social and environmental effects during project implementation. Where appropriate, community complaints will be directly addressed

D. Describe the monitoring and evaluation arrangements and provide a budgeted M&E plan.

Monitoring and Evaluation (M&E) measure the overall progress and impact of the project activities through the Baseline, Key Performance Indicators (KPI) and Targets to be achieved. They will be monitored regularly to identify the achievements or insufficiencies, therefore supporting the development of additional strategies to achieve the targets.

Monitoring and evaluation arrangements for the project activities

A monitoring and evaluation system will be developed to support the implementation and decision-makers team in designing, implementing, and adjusting the program activities. The overall (short, medium, and long-term) impact of the planned activities will also be assessed using the resources, methodologies, tools, etc. The monitoring and evaluation arrangements will have a gender-disaggregated system of data collection (baseline and target to be achieved as established in the context of the results framework of the project) and reporting for each of the project outcomes and components.

The M&E arrangements will be structured and organized at various levels of institutional set-up as shown under Table 23.

Table 23: M&E arrangements at various levels and responsibilities of stakeholders

Institutional level	Responsible actors	Support to the M&E framework
Local or Community level M&E activities	National Project Manager, Local Staff of Agencies (NMHS, Water Resources, Disaster Management), NGOs National External M&E expert	Collect Baseline, KPI, target to be achieved, means of verification for the activities implemented at the local level Updated checklists with the local project progress reports (LPPR) through semi-structure interviews or focus-group discussions, field visits consultation, Technical activity report
National level Monitoring and evaluation activities	Regional and National Project Manager, NMHSs staff, International M&E expert	Collect Baseline, KPI, target to be achieved, means of verification for the activities implemented at the National level Updated checklists with the National project progress reports (NPPR) through semi-structure interviews or focus-group discussions, field visits consultation, Technical activity report
Regional/Transboundary level Monitoring and evaluation activities	Regional and National Project Manager, NMHSs staff, International M&E expert	Collect Baseline, KPI, target to be achieved, means of verification for the activities implemented at the National level Updated checklists with the regional project progress reports (RPPR) through semi-structure interviews or focus-group discussions, field visits consultation, Technical activity report

Monitoring and evaluation arrangement for Project Management

The Project Management Unit (PMU) will be provided with monitoring and evaluation tools of project activities and resources. The PMU under the implementing and executing agencies will ensure that the executing agencies have adequate resources and capacity to measure and monitor results at the local, national and transboundary level. The quarterly monitoring and annual evaluation reports of the executing agencies along with the financial statements and resource management will be submitted to the implementing agency (WMO) and further to the Adaptation Fund Secretariat for the review.

The monitoring and evaluation assessment of the activities will be conducted regularly with the local, national and regional agencies and communities after which a report will be prepared to track progress made since the start of the project's and in particular from the previous reporting period. The reporting includes, but is not limited to, based on the following Table 24:

Table 24: M&E reporting details with timeline

Report content	**Additional Description**
Progress on the project's objective and outcomes – each with indicators, baseline data and end-of-project targets;	aggregated, gender disaggregated, percentage of change
Project outputs delivered per outcome (quarterly, half-yearly and yearly);	Activities completed for each output in the reporting period as compared to planned
Lessons learned/good practice and challenges;	Check or assess the real benefits to the stakeholders or challenges encountered
Progress on work plan and expenditure reports; and	Update on the work plan and use of funds
Project risk and adaptive management.	Any grievance or risk encountered during the period; any measures taken
Any other information as required	

Monitoring and Evaluation reports for project activities and management:

Quarterly report	Monitoring will be carried out after each quarter and reports will be prepared with key performance indicators, results achieved, issues encountered or potential problems and proposed solutions.
Annual Report	Annual report will be prepared to monitor the progress in the time period of twelve months. This will be useful to monitor progress made in different activities. The annual report will be presented by the project management unit to the Adaptation Fund (during submission of the yearly project progress report) and project advisory committee to assess the overall progress and provide their suggestions or feedback.

Mid-term Assessment Report	The project management will hire an independent evaluator to conduct the mid-term review after two years of kick-off to get the feedback of project stakeholders and external experts including suggestions for way forward.
Final Evaluation or Project Termination Report	After completion of the project, an independent evaluation will be conducted to check the overall impact of the project. The final evaluation report will be developed and presented to the Adaptation Fund secretariat and Board, project advisory committee and other stakeholders.

The M&E activities with their implementation plan are shown in the table 25 below:

Table 25: M&E activities with their implementation plan

Monitoring & Evaluation Activity List	Accountable Parties (short name)	Timeline																				Budget allocation
		2026		2027				2027				2028				2029				2030		
		Q 3	Q 4	Q 1	Q 2	Q 3	Q 4	Q 1	Q 2	Q 3	Q 4	Q 1	Q 2	Q 3	Q 4	Q 1	Q 2	Q 3	Q 4	Q 1	Q 2	
Design, development, and review of the Monitoring and Evaluation tools	WMO/NMHSs	X																				The budget will be provided during the proposal submission
Monitoring the project activities and outputs (quarterly)	NMHSs and NIPs	X	X	X		X	X	X		X	X	X		X	X	X		X	X	X		
Improvement or additional changes in the Monitoring tool	WMO/NMHSs																					
Monitoring the activities and reporting the project outputs (Annually)	WMO/NMHSs				X				X				X				X				X	
Mid-term Evaluation of the project activities and assessing the progress	WMO/NMHSs										X											
Final or Termination evaluation and reporting (after the completion of the project)	WMO/NMHSs																				X	

A detailed M&E tool (including updated baseline, KPI, target to be achieved etc.) will be made available for project activities, as well as for the project management team before the inception phase of the project which will be validated by various stakeholders.

E. Include a results framework for the project / programme proposal, including milestones, targets and indicators.

The results framework of the project defines the key performance indicators (KPI), baseline situation and means of verification for every component, outcomes, outputs and its activities. The KPI will be used during the monitoring and evaluation to assess the progress and divulge any scope for improvements. The regional entities (Volta Basin Authority (VBA), Economic Community of West African States(ECOWAS), West African Science Service Centre on Climate Change and Adapted Land Use(WASCAL), and AGRHYMET Regional Climate Centre for West Africa and the Sahel and national agencies (hydrology, meteorology, disaster management, agriculture, water resources, environment etc.) from the two countries will be involved in the development and finalization of the project result framework during the proposal development and inception phase of the project mainly to review and update the data and information.

F. Demonstrate how the project / programme aligns with the Results Framework of the Adaptation Fund

This part will be further developed in the full proposal, but the development of the VFDM Phase-2 project will be in line with the strategic results framework of the Adaptation Fund as provided under Table 26.

Table 26: VFDM Phase-2 alignment with the Results Framework of the Adaptation Fund

Fund Project Objective(s)[1]	Project Objective Indicator(s)	Fund Outcome	Fund Outcome Indicator	Grant Amount (USD)
Enhance the climate adaptive capacities and resilience to hydro-climatic risks across the entire countries of the Volta Basin – Ghana and Côte d'Ivoire, reducing vulnerability of over 60 million people[39]. The project supports this objective through integrated and cross-cutting solutions that span technical, institutional, and governance dimensions. It will scale early warning systems at the national scale, provide updated climate risk information and projections, and promote localized adaptation strategies.	By the end of year 5, at least 30,000,000 people directly(out of which 15,000,000 are women and youths) (and 60 million people indirectly) of the identified vulnerable population demonstrate improved preparedness and resilience to floods and droughts through the use of Early Warning Systems (EWS) and access to timely and accurate hydrological and meteorological forecasts provided by strengthened national agencies to save lives and improve livelihoods.	Outcome 1: Reduced exposure at national level to climate-related hazards and threats	1. Relevant threat and hazard Information generated and disseminated to stakeholders on a timely basis	1,000,000

[39] Combined population of Côte d'Ivoire and Ghana as of 2023, https://data.worldbank.org/indicator

Enhance the capacity of institutions and communities at all levels to understand, apply, and communicate climate-related risk information while promoting locally driven, nature-based resilience and preparedness solutions to hydroclimatic shocks and stresses.	By end of year 4, more than 100 Staffs (out of which 50 are women and youth) of the local /national hydrological and meteorological services, disaster management or civil protection etc.	Outcome 2: Strengthened institutional capacity to reduce risks associated with climate-induced socioeconomic and environmental losses	2.1. Capacity of staff to respond to, and mitigate impacts of, climate-related events from targeted institutions increased	7,500,000
	Before end of year 4, more than 100,000 people directly (out of which 50,000 are women and youths) have capacities to interpret, apply and communicate the hydroclimatic warning information to reduce socioeconomic and environmental losses	Outcome 3: Strengthened awareness and ownership of adaptation and climate risk reduction processes at local level	3.1. Percentage of targeted population aware of predicted adverse impacts of climate change, and of appropriate responses	3,750,000
Strengthen the overall resilience of vulnerable households and communities by promoting sustainable, diversified livelihood opportunities while enhancing governance frameworks that mainstream climate change adaptation and disaster risk reduction.	By the end of year 5, at least 10,000 vulnerable households (including 40% women-headed and youth-inclusive households) will have enhanced economic resilience through diversified and sustainable livelihood opportunities	Outcome 6: Diversified and strengthened livelihoods and sources of income for vulnerable people in targeted areas	6.1 Percentage of households and communities having more secure access to livelihood assets	1,000,000
	By year 5, atleast 10 new or revised national or local policies, regulations, or standards on improving climate change adaptation and disaster risk reduction strategies and integrated into development planning.	Outcome 7: Improved policies and regulations that promote and enforce resilience measures	7. Climate change priorities are integrated into national development strategy	2,750,000
Total objective level grant amount				16,000,000
Project Outcome(s)	**Project Outcome Indicator(s)**	**Fund Output**	**Fund Output Indicator**	**Grant Amount (USD)**
Outcome 1.1: Improved knowledge of risks, climate change impacts and risk-informed decision making at the local, national and regional levels	By the end of year 2, at least 2 national flood and drought risk maps for each targeted two Volta Basin countries will be developed and validated in 10 pilot locations (more than 5000 women and youth are involved), providing evidence-based support for disaster risk preparedness and management	Output 1.1: Risk and vulnerability assessments conducted and updated	1.1. No. of projects/programmes that conduct and update risk and vulnerability assessments (by sector and scale)	1,000,000
	By the end of year 2, 50,000 individuals, including 25,000 women and youth, will have improved awareness of future climate risks and impacts on economic, urban, environmental, and related sectors and provide support in improving livelihood strategies.	Output 6: Targeted individual and community livelihood strategies strengthened in relation to climate change impacts, including variability	6.1.1. No. and type of adaptation assets (tangible and intangible) created or strengthened in support of individual or community livelihood strategies	1,000,000
Outcome 1.2 Preparedness and resilience to climate change promoted through innovative and community-based and nature-based initiatives	By year 4, more than 40,000,000 people directly or indirectly in the two countries have improved awareness of future risks and impacts on economic, urban, climate, environment etc. due to climate change variabilities	Output 7: Improved integration of climate-resilience strategies into country development plans	7.2. No. of targeted development strategies with incorporated climate change priorities enforced	2,000,000
Outcome 2.1 Established national inventories of hydro-meteorological data and information for developing tools and products on hydrological and meteorological services including water resources management	By year 4, more than 30 hydro-meteorological monitoring stations have been rehabilitated and one national centralized data collection system in each country is updated and functional for hydrological and meteorological services including water resources management, mitigating the impacts of climate related events	Output 2.1: Strengthened capacity of national and sub-national centers and networks to respond rapidly to extreme weather events	2.1.1. No. of staff trained to respond to, and mitigate impacts of, climate-related events (by gender)	2,500,000
Outcome 2.2 Integrated Multi Hazar Early Warning Systems (EWS) and web-based Hydrological Status and Outlook System is designed and	By year 5, 60,000,000 of population in Côte d'Ivoire and Ghana have direct or indirect access to MHEWS with HydroSOS system operational and warning services has been utilized for adaptation and risk reduction activities.	Output 3.1: Targeted population groups participating in adaptation and risk reduction awareness activities	3.1.1 No. of news outlets in the local press and media that have covered the topic	3,000,000

integrated together with the national hydrometeorological agencies and re centers	By year 4, Atleast 10 pilot locations of each targeted Volta Basin countries have been tested with developed MHEWS with HydroSOS tool and models with involvement of more than 100,000 people (50,000 are women and youths) in each country	Output 2.1: Strengthened capacity of national and sub-national centres and networks to respond rapidly to extreme weather events	2.1.2. No. of targeted institutions with increased capacity to minimize exposure to climate variability risks (by type, sector and scale)	2,000,000
Outcome 2.3: Strengthened technical capacity and coordination at national and regional level to improve early warning and facilitate response actions to safeguard populations and economic activities	By year 5, more than 100 staff of the local, regional and national agencies and more than 10000 community representatives (40-50% of them are women and youths) have developed technical capacities for responding to climate change events for safeguarding populations and economic activities	Output 2.1: Strengthened capacity of national and sub-national centers and networks to respond rapidly to extreme weather events	2.1.1. No. of staff trained to respond to, and mitigate impacts of, climate-related events (by gender)	3,000,000
Outcome 3.1 Improved information base and practices to facilitate implementation of evidence-based strategies for improving policies, plans and actions plans (INDC, NAP and NAPA) with local collaboration	By the end of year 5, more than 10 national and regional plans, policies and guidelines on water resources management and climate change adaptation documents have been reviewed and updated with necessary amendments.	Output 3.2: Strengthened capacity of national and subnational stakeholders and entities to capture and disseminate knowledge and learning	3.2.2 No. of tools and guidelines developed (thematic, sectoral, institutional) and shared with relevant stakeholders	750,000
Outcome 3.2 Strengthened capacities of policy makers and decision makers at national and transboundary level on long term risk management policies, plans and strategies.	By end of year 5, more than 10,000 locals/national/regional stakeholders (around 5000 are women and youths) have participated in review of several risk management related policies, plans for integration into national and transboundary development plans.	Output 7: Improved integration of climate-resilience strategies into country development plans	7.1. No., type, and sector of policies introduced or adjusted to address climate change risks	450,000
	By end of year 5, more than 10,000 (around 5000 are women and youths) Locals/national/regional Stakeholders have provided recommendations and suggestions for integration of climate resilience and risk management related policies, plans into national and transboundary development plans.	Output 7: Improved integration of climate-resilience strategies into country development plans	7.2. No. or targeted development strategies with incorporated climate change priorities enforced	300,000
Total outcome level grant amount				16,000,000

G. Include a detailed budget with budget notes, broken down by country as applicable, a budget on the Implementing Entity management fee use, and an explanation and a breakdown of the execution costs.

The total budget of the VFDM phase 2 project is estimated at USD 18,600,000 for the implementation of activities in the two participating countries, including an amount of USD 1,600,000 for project executing entities (WMO as one of the executing entities will charge 1.5% (USD 24,000) of the total executing fees) and an amount of USD 1,760,000 to cover the expenses of the implementing entity (WMO). A detailed budget including budget notes and disbursement schedule will be presented during the proposal development stage.

Approximate distribution of the Total cost (USD) that will be devoted to each country and at the regional levels during the project period.

Côte d'Ivoire	Ghana	Regional/Transboundary	IE and EEs fees
6,500,000	6,500,000	3,000,000	3,360,000

PART IV: ENDORSEMENT BY GOVERNMENTS AND CERTIFICATION BY THE IMPLEMENTING ENTITY

A. Record of endorsement on behalf of the government[40]

Côte d'Ivoire Mr. Marcel Yao Director International Cooperation and Financing Mobilization Directorate of International Cooperation and Financing Mobilization Plateau, Tower A, 4th Floor Côte d'Ivoire	Date: *02 July 2025*

6. Each Party shall designate and communicate to the secretariat the authority that will endorse on behalf of the national government the projects and programmes proposed by the implementing entities.

THE REPUBLIC OF GHANA

MINISTRY OF ENVIRONMENT, SCIENCE AND TECHNOLOGY

P.O. Box M232, Ministries – Accra
Digital Address: GA-107-3037
Kindly quote this number and date on all correspondence:
My Ref. No.: _____
Your Ref. No.: _____

Date: 30th May 2025

LETTER OF ENDORSEMENT: SCALING UP INTEGRATED FLOOD AND DROUGHT MANAGEMENT AND EARLY WARNING SYSTEM FOR CLIMATE CHANGE ADAPTATION IN THE VOLTA BASIN COUNTRIES (VFDM PHASE-II)

In my capacity as Designated Authority for the Adaptation Fund in Cote d'Ivoire/Ghana, I confirm that the above regional grant proposal is in accordance with the government's national priorities in implementing adaptation activities to reduce adverse impacts of, and risks, posed by climate change in Cote d'Ivoire/Ghana region.

Accordingly, I am pleased to endorse the above grant proposal with support from the Adaptation Fund. If approved, the project will be implemented by the World Meteorological Organization (WMO) and executed by the World Meteorological Organization (WMO), National Meteorological Agencies of the targeted countries (Société d'exploitation et de développement aéroportuaire, aéronautique et météorologique (SODEXAM) and Ghana Meteorological Agency (GMet)) in close coordination with the climate change focal ministry in these two countries

DR. PETER DERY,
DIRECTOR, ENVIRONMENT /
OPERATIONAL FOCAL POINT,
ADAPTATION FUND
***for*: MINISTER**

THE ADAPTATION FUND BOARD
c/o ADAPTATION FUND BOARD SECRETARIAT

Tel: +233 (0) 302 662 626
Email: info@mest.gov.gh
Website: www.mest.gov.gh

MINISTRY OF ENVIRONMENT, OF SUSTAINABLE DEVELOPMENT AND ECOLOGICAL TRANSITION

DIRECTORATE OF INTERNATIONAL COOPERATION AND FUNDING MOBILIZATION

N° 0 0 0 1 1 1 /MINEDDTE/CAB/DCIMF

REPUBLIQUE OF COTE D'IVOIRE
Union - Discipline – Work

Abidjan, the 02 JUIL 2025

ADAPTATION FUND

Letter of Endorsement by Government

To: **Adaptation Fund Board**
c/o Adaptation Fund Board Secretariat, NW
Washington, DC 20433 USA
Email: afbsec@adaptation-fund.org
Fax : 202 522 3240/5

Subject: Endorsement for Scaling up Integrated Flood and Drought Management and Early Warning System for climate change adaptation in the Volta Basin Countries (VFDM Phase-II)

In my capacity as designated authority for the Adaptation Fund in the Republic of Côte d'Ivoire, I confirm that the above regional grant proposal is in accordance with the government's national priorities in implementing adaptation activities to reduce adverse impacts of, and risks, posed by climate change in Cote d'Ivoire region.

Accordingly, I am pleased to endorse the above grant proposal with support from the Adaptation Fund. If approved, the project will be implemented by the World Meteorological Organization (WMO) and executed by the World Meteorological Organization (WMO), National Meteorological Agencies of the targeted countries (Société d'exploitation et de développement aéroportuaire, aéronautique et météorologique (SODEXAM) and Ghana Meteorological Agency (GMet)) in close coordination with the climate change and environment focal ministry in these two countries.

Sincerely

Ministère de l'Environnement, du Développement Durable et de la Transition Ecologique — Direction de la Coopération Internationale et de la Mobilisation des Financements — Le Directeur

Colonel YAO MARCEL
Director of International Cooperation and Financing Mobilisation
Entity designated by the Adaptation Fund
Tel: +225 07 07 79 15 04
Email: ensamarcel@yahoo.fr

GHANA METEOROLOGICAL AGENCY

East Legon-Mempeasem
P.O. Box LG 87, Legon-Accra
Digital address: GA-485-3581
Kindly quote this number and date on all correspondence

My Ref. No. **WMO 1/Vol 4/06**

Your Ref. No. _____

Date. **21st May 2025**

Prof Celeste Saulo
Secretary-General
World Meteorological Organization
7bis Avenue de la Paix
Case postale 2300 Nations,
1211 Geneva

Subject: Endorsement and commitment to provide operational support for the Scaling up Integrated Flood and Drought Management and Early Warning System for climate change adaptation in the Volta Basin Countries (VFDM Phase 2)

We would like to confirm the endorsement and commitment of the Ghana Meteorological Agency (GMet) as National Meteorological Services (NMSs) of Ghana participation in all VFDM phase-II project development activities aiming towards the achievement of the Multi Hazard EWS objectives to the benefit of Ghana and the Volta Basin region as a whole as. GMet has signed a Memorandum of Understanding with Société d'exploitation et de développement aéroportuaire, aéronautique et météorologique (SODEXAM) to strengthen climate services delivery which will aid the implementation of the VFDM Phase 2.

We request WMO as the Implementing entity of the proposed regional project to submit the VFDM Phase-II project concept note to the Adaptation Fund during June 2025 for funding. GMet is ready to be a lead executing partner of VFDM Phase 2 for Ghana based on our experience in the successful implementation of VFDM Phase 1 for sustainability.

GMet is committed to provide during the project development, implementation and after its completion meteorological, hydrological (in collaboration with Ghana Hydrological Authority (HYDRO)) and climatological data from its existing network of observation stations and related information required for the sustainable operation of the Multi Hazard Early Warning System. GMet will also provide in-kind support (staff and resources) to complete additional activities under the proposed project such as community-based activities, development of flood and drought risks maps and how they are impacted by climate scenarios.

The Ghana Meteorological Agency will ensure that the resources and information are made available to World Meteorological Organization solely for the purpose of development, operation and maintenance of the Early Warning System. We will continue to apply and maintain the developed products and approaches advanced with this early warning system after the project for climate resilience and disaster risk reduction.

Yours sincerely,

Dr. Eric Asuman
Director-General and Permanent
Representative of Ghana with WMO

sodexam

REPUBLIQUE DE CÔTE D'IVOIRE

UNION – DISCIPLINE - TRAVAIL

Date 21st May 2025

Prof Celeste Saulo
Secretary-General
World Meteorological Organization
7bis Avenue de la Paix
Case postale 2300 Nations,
1211 Geneva

Subject: Endorsement and commitment to provide operational support for the Scaling up Integrated Flood and Drought Management and Early Warning System for climate change adaptation in the Volta Basin Countries (VFDM Phase 2)

We would like to confirm the endorsement and commitment of the Société d'Exploitation et de Développement Aéroportuaire, Aéronautique et Météorologique (SODEXAM) as National Meteorological Services (NMSs) of Cote d'Ivoire participation in all VFDM phase-II project development activities aiming towards the achievement of the Multi Hazard EWS objectives to the benefit of Cote d'Ivoire and the Volta Basin region as a whole.

We request WMO as the Implementing entity of the proposed regional project to submit the VFDM Phase-II project concept note to the Adaptation Fund during June 2025 for funding.

SODEXAM is committed to provide during the project development, implementation and after its completion meteorological, hydrological and climatological data from its existing network of observation stations and related information required for the sustainable operation of the Multi Hazard Early Warning System. SODEXAM will also provide in-kind support (staff and resources) to complete additional activities under the proposed project such as community-based activities, development of flood and drought risks maps and how they are impacted by climate scenarios.

SODEXAM will ensure that the resources and information are made available to World Meteorological Organization solely for the purpose of development, operation and maintenance of the Early Warning System. We will continue to apply and maintain the developed products and approaches advanced with this early warning system after the project.

Sincerely,

Représentation Permanente de la Côte d'Ivoire
1er Vice Président
Représentant Permanent
Affaires de l'O.M.M.

Daouda Konate
1st Vice President of WMO
Permanent Representative of Cote d'Ivoire with WMO
Director of National Meteorology

Project Formulation Grant (PFG)

Submission Date: 08 January 2026
Adaptation Fund Project ID: N/A
Country/ies: Côte d'Ivoire and Ghana

Title of Project/Programme: Scaling up Integrated Flood and Drought Management and Early Warning System for climate change adaptation in the Volta Basin Countries (VFDM Phase-II)

Type of IE (NIE/RIE/MIE): MIE
Implementing Entity: World Meteorological Organization (WMO)

Executing Entity/ies: World Meteorological Organization (WMO), Société d'exploitation et de développement aéroportuaire, aéronautique et météorologique (SODEXAM) and Ghana Meteorological Agency (GMet)

A. Project Preparation Timeframe

Start date of PFG	20 April 2026
Completion date of PFG	30 October 2026

B. Proposed Project Preparation Activities ($)

List of Proposed Project Preparation Activities (Lead executing entities and supporting executing entities)	Output of the PFG Activities	USD Amount	Budget Notes
Hire consultants to draft project proposal and organize and conduct consultations with agencies and partners of the past and on-going projects in the targeted region to understand their expertise, experience, and to identify connections with the local stakeholders and beneficiaries, available resources and services, communication channels etc. Lead entity- WMO	Meetings are successfully conducted, and past or on-going project knowledge, experience and contacts are noted and shared with WMO and other executing partners, which will be integrated into the full project proposal.	37,000	Hiring of the expert staff/service to prepare the proposal (500 USD/day for 50 days equivalent to 25,000 USD, 3000 USD for travels to the countries/communities and consultation meetings related costs (national/local workshops) and community-based consultations equivalent to 2000 USD and WMO Staff Travel and daily allowances of 7000 USD)

Supporting entities: SODEXAM and GMet			
Performing a regional consultation workshop involving implementing and executing entities along with national partners of the two countries, finalizing roles and responsibilities, project result framework, M&E plan, budget, and time estimation for implementing each activity of the VFDM phase-II project Lead entities: SODEXAM and GMet Supporting entity: WMO	Roles and responsibilities of each stakeholder are assigned, M&E, project result framework, budget and time period for every activity are finalized along with the list of potential partners is identified with their budget estimation.	28,000	3 days regional workshop mainly logistical, travel arrangement, and interpretation related costs (20 plus participants from the national and regional agencies, other IO and NGOs, WMO etc.)
Hire consultant(s) to conduct and contribute to the development of the environmental and social risk management plan of the VFDM phase-II project through the environmental and social impact assessment (ESIA) and Gender Assessment (development of Gender Action plan) aligning with the Environmental and Social (ES) and Gender policies of the Adaptation Fund Lead entities: SODEXAM and GMet Supporting entity: WMO	Environmental and social risk management plan is available and included in the project proposal	28,000	Hire the consultants (daily rate of approx. 300 USD/per day for upto 60 days totaling 18,000 USD including local travel costs) with experience in conducting EIA and SIA studies with consultations of relevant stakeholders at regional, national and local levels. The draft EIA and SIA will be validated through national/regional workshop (costing 10,000 USD with 30 participants out of which 12-15 participants will be women and youth) to get endorsement of EIA and SIA study report (including ESMP) from relevant stakeholders of the two countries
IE project support or admin fee (7%)		7000	
Total Project Formulation Grant		100,000	

C. Implementing Entity

This request has been prepared in accordance with the Adaptation Fund Board's procedures and meets the Adaptation Fund's criteria for project identification and formulation

Implementing Entity Coordinator, IE Name	Signature	Date (Month, day, year)	Project Contact Person	Telephone	Email Address
Moyenda Chaponda		December 8 2025	Ramesh Tripathi	+41227308321	rtripathi@wmo.int

Tel: +225 07 07 79 15 04 Email: ensamarcel@yahoo.fr	
Ghana Mr. Peter Justice Dery Director for Environment Ministry of Environment, Science, Technology and Innovation P.O. Box M232, Accra Ghana Tel: +233 302 666 049, +233 343 647 49 Email: Peterjdery@yahoo.com;	Date*: 30 May 2025*

B. Implementing Entity certification

I certify that this proposal has been prepared in accordance with guidelines provided by the Adaptation Fund Board, and prevailing National Development and Adaptation Plans and subject to the approval by the Adaptation Fund Board, commit to implementing the project/programme in compliance with the Environmental and Social Policy of the Adaptation Fund and on the understanding that the Implementing Entity will be fully (legally and financially) responsible for the implementation of this project/programme.	
Moyenda Chaponda *Moyenda Chaponda* *Implementing Entity Coordinator* *Office for Resource Mobilization and Development Partnerships*	
Date *December 08, 2025*	Tel. and email: +41 22 730 8646 and mchaponda@wmo.int
Project Contact Person: Ramesh Tripathi	
Tel. And Email: +41227308321, rtripathi@wmo.int	

Annexes

Annex 1: Initial Gender Assessment Report for the VFDM phase-2 project in Cote d'Ivoire and Ghana

This initial gender assessment for VFDM-Phase 2 project provides a comprehensive overview of gender-related issues relevant to the development and implementation of the project, understanding gender related issues for floods and drought, identifying opportunities for promoting gender equality and inclusive approaches and ensuring that interventions address the differentiated needs, vulnerabilities, and capacities of women, men, girls, and boys, elderly as far as possible, an intersectional approach, i.e. considering also further potential vulnerability factors such as age, sexual orientation, disability, and ethnicity. The report supports the project Implementing and Executing Partners commitment to integrating gender perspectives across climate adaptation and disaster risk reduction programming and aligns with the Adaptation Fund's Gender Policy and Action Plan as well as existing national standard plans and policies on gender mainstreaming approaches in the two targeted countries.

Some of the key barriers identified related to Gender Equality and Inclusion approaches for climate change adaptation and disaster risk management in the two targeted countries

Barrier	**Description**
Limited Access to Information and Technology	Women have less access to digital devices and mobile data, reducing the effectiveness of early warning messages.
Low Participation in Institutional Decision-Making	Few women hold leadership roles in meteorological services, water governance, and local government
Participation to capacity development activities	Heavy care burdens reduce women's ability to attend training or participate in adaptation planning.
Inadequate Representation in Climate Science and Hydromet Professions	The gender gap in technical disciplines limits the pool of women engaged in forecasting, modelling, and risk assessment.

Baseline and monitoring methods and reporting on gender related activities under Volta phase-2

A. Data Collection

- Sex-disaggregated beneficiary registration
- Activity attendance sheets (segregated by sex, age, disability status)
- Digital data collection tools (through survey sheets) with involvement of youths and other stakeholders

B. Qualitative Monitoring

- Focus group discussions (separate groups for women and men when needed)
- Key informant interviews with women leaders and gender focal persons

- Participatory monitoring sessions with community groups

C. Observation
- How women/men interact during activities
- Whether women have equal speaking time and decision-making influence
- Safe spaces and privacy measures for women participants

D. Case Studies / Success Stories
- Document stories of improved women and youth empowerment
- Capture lessons learned and best practices

Opportunities for Gender-Responsive Programming

Opportunity	Action
Build on community-based adaptation efforts	Engage women's groups, agricultural cooperatives, and youth networks in pilot projects and training.
Enhance ICT-enabled outreach	Tailor digital content for women, including voice-based alerts and local-language radio broadcasts.
Bridge the gap in technical participation	Establish scholarships or mentorships for young women in meteorology, hydrology, and engineering.
Leverage traditional knowledge	Integrate women's local knowledge of water cycles and farming systems into resilience strategies.

Changing gender dynamics might drive lasting change in the Volta Basin through VFDM phase-2 project

1) Improving risk management outcomes
Key changes
- Women and youths gain equal access to climate information, early warnings, and capacity development initiatives.
- Part of the decision-making bodies and processes
- Gender-responsive communication channels are institutionalized.

Lasting impacts to improve flood and drought management
- Preparedness through risk knowledge and awareness,
- Decisions on water use, storage, and
- Communities respond faster (Flood evacuation improves at household and community levels).

2) Strengthening local governance and ownership
Key changes
- Women's and youths representation increases in:
  - Water user associations
  - Flood management committees
  - Community disaster risk platforms

Lasting impacts to improve flood and drought management
- Governance becomes more inclusive and legitimate.
- Institutions reflect real water-use patterns, not just formal land ownership.

Result
- Community-level flood and drought plans are maintained beyond project timelines.

3) Transforming social norms around water and climate risk
Key changes
- Gender norms shift from "women and youths as beneficiaries" to "women as active risk managers and leaders."
- Men become allies in adaptation and resilience-building.

Lasting impacts to improve flood and drought management
- Normative change persists after infrastructure and funding end.
- Younger generations internalize new roles and expectations.

Below is the initial Gender Assessment report for the VFDM Phase-2 project
Initial Gender Assessment Report for the Volta Phase-II project December 2025

Note: this initial gender assessment report will be further developed in the next phase of the project proposal development (with Gender action plan and associated budget) following consultation with different stakeholders at local, national and regional levels including marginalized, vulnerable groups including women, youths and elderly etc.