**United Nations Development Programme**

**Country: Zambia**

# PROJECT DOCUMENT

**Project Title:** Strengthening climate information and early warning systems in Eastern and Southern Africa for climate resilient development and adaptation to climate change – Zambia

**UNDAF Outcome(s):** (2) Targeted populations in rural and urban areas attain sustainable livelihoods; (3) Vulnerable people in Zambia have improved quality of life and wellbeing by 2015 Human Development; (4) People's vulnerability reduced from the risk of Climate Change, natural and man-made disasters and environmental degradation; and (5) Targeted government institutions provide human rights-based policies, frameworks and services.

**UNDP Strategic Plan Environment and Sustainable Development Primary Outcome:** Promoting adaptation to climate change.

**Expected CP Outcome(s):** 2.1) Government and partners enable vulnerable populations to be food secure by 2015; 4.1) Disaster Management and Mitigation Unit (DMMU) has a fully functional national disaster management and early warning system to prevent, alert and respond to disasters by 2015; 4.2) Government promotes adaptation and provide mitigation measures to protect livelihoods from climate change by 2015; and 4.3) Government implements policies and legal frameworks for sustainable community based natural resources management by 2015.

**Expected CPAP Output (s):**2.1.1) Increased access to financial services and agricultural inputs to Small and medium-scale farmers and other vulnerable groups; 4.1.1) A legal framework for coordination of disaster response and management is developed; 4.2.1) Increased adoption of sustainable land management and agriculture practices to adapt to risks of climate change among small scale farmers; 4.2.2) Revised agricultural and land policies and legal frameworks reviewed to take into account climate change; and 4.3.1) Functional mechanisms to ratify/ domesticate conventions on biodiversity conservation, combating desertification, climate change, ozone depleting substances, water and Convention on International Trade in Endangered Species; and 4.3.3) Increased environment awareness at national and local levels.

**Executing Entity/Implementing Partner:** Ministry of Transport, Works, Supply and Communication (Zambia Meteorological Department)

**Implementing Entity/Responsible Partners:** Disaster Management and Mitigation Unit (DMMU), Department of Water Affairs (DWA)/Water Resource Management Authority (WRMA), Ministry of Agriculture and Livestock (MAL), Ministry of Health (MoH), Central Statistics Office (CSO), and Interim National Climate Change Secretariat (INCCS).

## Brief Description

Zambia is vulnerable to the impacts of floods and droughts, which are predicted to increase in frequency and severity as a result of climate change. Rural Zambian communities, the majority of which comprise small-scale farmers, are particularly vulnerable because of their dependence on rain-fed agriculture and natural resource-based livelihoods. At present, the meteorological observation network in Zambia is not capable of producing the required climate information to support risk management in the short or long term. To increase the ability of Zambia to adapt to the impacts of climate change, it will be necessary to strengthen the generation of appropriate climate information to monitor and predict slow-onset climate hazards such as droughts and increased temperatures, as well as rapid-onset hazards such as river floods, including flash-floods. This information needs to be disseminated to end-users through an appropriate Early Warning System (EWS). Zambia currently has components of a functional EWS, however, these activities are uncoordinated and limited in their relevance for planning for and managing uncertainties of long-term climate change.

To realise the long-term development planning benefits of a streamlined, customized and consolidated EWS informed by accurate climate information, this Least Developed Country Fund (LDCF)-financed project will take a two-pronged approach by: i) increasing the geographic distribution of meteorological monitoring stations at the national level; and ii) enabling communication channels for the dissemination of primarily flood and drought early warnings, including implementing two-way, community-based EWSs in three vulnerable districts in Zambia, namely Chipata, Gwembe and Sesheke. The following two outcomes will be delivered through this Government of the Republic of Zambia (GRZ)-led initiative:

- enhanced capacity of Zambia Meteorological Department (ZMD) to monitor and forecast extreme weather events and climate change; and
- efficient and effective use of hydro-meteorological and environmental information for generating early warnings and informing long-term development plans.

To achieve these outcomes, LDCF financing will be used to overcome key barriers including: i) inadequate weather and climate information infrastructure, which limits data collection, analysis and provision of meteorological services; ii)limited knowledge and capacity to effectively forecast future climate events as a result of an acute shortage of technology and skilled human resources; iii)weak institutional coordination between institutions leading to limited packaging, translating and disseminating of climate information and warnings; and iv) no long-term sustainability of observational infrastructure and technically skilled human resources. This LDCF-financed project, which builds on several on-going baseline development initiatives, will be implemented by the ZMD within the Ministry of Transport, Works, Supply and Communication, and is expected to be completed by the third quarter of 2017.

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| Programme Period: | 2013-2017 |
| Atlas Award ID: | 00074216 |
| Project ID: | 00086729 |
| PIMS # | 5091 |
| Start date: | September 2013 |
| End Date | September 2017 |
| Management Arrangements | NIM |
| PAC Meeting Date | 31 July 2013 |

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| Total resources required | US$ 17,131,947 |
| Total allocated resources: | US$ 17,131,947 |
| • GEF/LDCF | US$ 3,600,000 |
| • Government (In Kind) | US$ 3,746,947 |
| • UNDP (Grant) | US$ 600,000 |
| • UNDP (Cash) | US$ 400,000 |
| • Other | US$ 8,785,000 |

Agreed by (Government):

Date/Month/Year

Agreed by (Executing Entity/Implementing Partner):

Date/Month/Year

Agreed by (UNDP):

Date/Month/Year

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**List of Acronyms**

| | |
|---|---|
| AfDB | African Development Bank |
| AMESD | African Monitoring of the Environment for Sustainable Development |
| APR | Annual project Review |
| ASEWS | Agricultural Statistics and Early Warning Section |
| AUC | Commission of the African Union |
| AWS | Automatic Weather Stations |
| CCA | Climate Change Adaptation |
| CCFU | Climate Change Facilitation Unit |
| CEOS | Committee on Earth Observation Satellites |
| CGMS | Coordination Group for Meteorological Satellites |
| ClimDev-Africa | Climate for Development in Africa Programme |
| COMESA | Common Market of Eastern and Southern Africa |
| CORDEX | Coordinated Regional Climate Downscaling Experiment |
| CSO | Central Statistics Office |
| DDMC | District Disaster Management Committee |
| DMI | Danish Meteorological Institute |
| DMMU | Disaster Management and Mitigation Unit |
| DRR | Disaster Risk Reduction |
| DWA | Department of Water Affairs |
| ENSO | El Niño/Southern Oscillation |
| EOC | Emergency Operation Centre |
| EUMETSAT | European Organisation for the Exploitation of Meteorological Satellites |
| EWS | Early warning system |
| FA | Focal area |
| FEWSNET | Famine and Early Warning Systems Network |
| FMI | Finnish Meteorological Institute |
| FNDP | Fifth National Development Plans |
| GCOS | Global Climate Observing System |
| GDP | Gross Domestic Product |
| GEF | Global Environment Facility |
| GEO | Group on Earth Observations |
| GFCS | Global Framework Climate Services |
| GIZ | Gesellschaftfür Internationale Zusammenarbeit |
| GPRS | General Packet Radio System |
| GRZ | Government of the Republic of Zambia |
| GSM | Global System for Mobile Communication |
| GTS | Global Telecommunication System |
| ICSU | International Council for Science |
| IFC | International Finance Corporation |
| IOC | Intergovernmental Oceanographic Commission |
| INCCS | Interim National Climate Change Secretariat |
| IT | Information Technology |
| ITCZ | Inter-Tropical Convergence Zone |
| IWRM | Integrated Water Resources Management |
| KFW | German Investment Bank |
| KP | Kyoto Protocol |
| LDC | Least Developed Country |
| LDCF | Least Developed Country Fund |

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|---|---|
| LLDC | Landlocked Developing Country |
| MAL | Ministry of Agriculture and Livestock |
| MASA | Meteorological Association of Southern Africa |
| MDG | Millennium Development Goal |
| MESA | Monitoring of Environment and Security in Africa |
| MoH | Ministry of Health |
| MTENR | Ministry of Tourism, Environment and Natural Resources |
| NAP | National Agricultural Policy |
| NAPA | National Adaptation Programmes of Action |
| NCSA | National Capacity Self-Assessment |
| NDMP | National Disaster Management Policy |
| NDMTC | National Disaster Management Technical Committee |
| NEWDMC | National Early Warning and Disaster Management Committee |
| NEWTC | National Early Warning Technical Committee |
| NGO | Non-Governmental Organisation |
| NIP | National Irrigation Plan |
| NEP | National Environment Policy |
| NWP | Numerical Weather Prediction |
| ODP | Operating Data Platform |
| PDMC | Provincial Disaster Management Committee |
| PIR | Project Implementation Report |
| PPCR | Pilot Program for Climate Resilience |
| PRSP | Poverty Reduction Strategy Paper |
| PUMA | Preparation for the Use of MSG in Africa |
| RANET | Radio and Internet |
| RCM | Regional Climate Model |
| SADC | Southern African Development Community |
| SADC-HYCOS | Southern African Development Community Hydrological Cycle Observing System |
| SADIS | Satellite Distribution System |
| SAMPRO | SADC Regional Meteorology Project |
| SARCOF | Southern Africa Regional Climate Outlook Forum |
| SASSCAL | Southern Africa Science Service Centre for Climate Change and Adaptive Land Management |
| SBAA | Standard Basic Assistance Agreement |
| SCCF | Special Climate Change Fund |
| SDMC | Satellite Disaster Management Committee |
| SEVIR | Regional Visualization and Monitoring System |
| SIP | Seasonal to Inter-annual Predictions |
| SMS | Short Message Service |
| SNDP | Sixth National Development Plans |
| SOP | Operating Procedures |
| UHF | Ultra High Frequency |
| UN | United Nations |
| UNCBD | United Nations Conventions on biodiversity |
| UNCCD | United Nations Conventions to combat desertification |
| UNDAF | United Nations Development Assistance Framework |
| UNDP | United Nations Development Programme |
| UNEP | United Nations Environment Programme |
| UNECA | United Nations Economic Commission for Africa |

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|---|---|
| UNESCO | United Nations Educational Scientific and Cultural Organization |
| UNFCCC | United Nations Framework Convention on Climate Change |
| UNZA | University of Zambia |
| VAC | Vulnerability Assessment Committee |
| WB | World Bank |
| WFP | World Food Programme |
| WHYCOS | World Hydrological Observing System |
| WIAG | World Hydrological Observing System (WHYCOS) International Advisory Group |
| WMO | World Meteorological Organization |
| WRMA | Water Resources Management Authority |
| ZEMA | Zambia Environmental Management Authority |
| ZEPRIS | Zambia Emergency Preparedness Response Information System |
| ZESCO | Zambia Electricity Supply Corporation Limited |
| ZMD | Zambia Meteorological Department |
| ZRA | Zambezi River Authority |

# 1. SITUATION ANALYSIS

1. Over the past three decades, floods and droughts have already cost Zambia ~US$ 13.8 billion, equivalent to a 0.4% loss of annual economic growth[1]. In total, 9 million people have been affected and there have been 71 deaths[2]. The 2007 floods were particularly destructive and affected more than 1.5 million people in 41 out of 72 districts in the 10 Zambian provinces. In several of those districts, it was the first time that they had been affected by flooding[3]. It is estimated that rainfall variability alone could keep an additional 300,000 Zambians below the poverty line and cost Zambia US$ 4.3 billion in lost Gross Domestic Product (GDP) over the next decade, reducing annual GDP growth by 0.9%[4].

2. Anthropogenic-induced climate change is expected to exacerbate the effects of floods and droughtsbecause of the predicted increase in frequency and severity of climate hazards. This will increase the vulnerabilities of many sectors, livelihoods and assets within Zambia and the broader region in general. The primary impacts of climate change are expected to be: i) an increase in the mean annual temperature of 1.2-3.4°C by 2060[5]; and ii) a decrease in rainfall during the September to November period and an increase during December to April, along with accompanying increases in high intensity rainfall and 1-5 day total rainfall.These changes are predicted to result in: i) seasonal droughts; ii) dry periods within the rainy season; iii) intense rainfall; iv) heat waves; v) increased temperatures in valleys; vi) floods; vii) flash floods; and viii) changes in growing season (as a result of delayed onset of rainy season or shortened growing period)[6].

3. A climate information and Early Warning System (EWS) is an important part of adapting to the above mentioned climate change-related impacts, as it increases the resilience to future changes in these climate/weather-related hazards. Whilst components of such a system are operational in Zambia, efforts are fragmented, distributed across numerous institutions, and based on limited climate/weather information.

## 1.1 The problem the project seeks to address

4. The fundamental problem that this project seeks to address is that a coordinated and complete climate information (including weather monitoring and forecasting) and EWS in Zambia does not yet exist. This limits the effectiveness of long-term development planning and the delivery of timely climate/weather-related warnings to key sectors and communities vulnerable to climate change impacts such as an increase in frequency and intensity of floods and droughts.

5. Reasons for this ineffective climate information and EWS include a lack of both hard and soft technologies, and the capacity to utilise those technologies in an appropriate manner. This results in: i) a limited understanding of current and future weather- and climate-related risks; ii) limited monitoring and forecasting of climate-related hazards; iii) inappropriate communication and packaging of early warnings; iv) restricted responses to impending weather- and climate-induced disasters; and v) constrained planning for slow-onset climate hazards that will require a transformational shift in economic development and risk reduction efforts. The infrastructure, technology and capacity on which to build these services is lacking in Zambia.Without the necessary investments to generate climate information – especially the monitoring and forecasting of climate and extreme weather-related hazards – the weather and climate monitoring and EWS network in Zambia will not function as effectively as it could, lowering the potential resilience of sectors and vulnerable communities.

[1]World Bank 2009.Zambia managing Water for sustainable growth and poverty Reduction.A country water assistance strategy for Zambia.World Bank Water Resources Management Africa Region Report 52963, Washington DC.
[2]Official data states that there have been 71 deaths, however, anecdotal evidence suggests this number to be much higher.
[3] Zambia National Adaptation Programme of Action, September 2007.
[4]Thurlow, J., Zhu T. and Diao, X., 2009.The impact of climate variability and change on economic growth and poverty in Zambia.IFPRI Discussion Paper 00890, International Food and Policy Research Institute, Washington.
[5] http://country-profiles.geog.ox.ac.uk/
[6]Zambian National Adaptation Programme of Action, 2007.

6. Presently there is insufficient coverage of meteorological and hydrological observation stations,which hasresulted in limited monitoring of vulnerable regions and populations. Besides 25 automatic weather stations (AWSs) which are planned for installation and two operational AWSs, existing stations are manually operated. While data is reported regularly from these manual stations, transmission is not as efficient or reliable as for automated stations. Equipment failure is also common, and regular checks and maintenance often neglected because of insufficient funds, incentives and regulatory policies. This results in lowquality and unreliable data for making management decisions related to climate change induced disaster risks. Furthermore, there is currently limited packaging and inappropriate communication of weather and climate information and warnings for different end-users and/or sectors. This results in limited information flow and coordination between different agencies, in particular Zambia Meteorological Department (ZMD), Disaster Management and Mitigation Unit (DMMU), Department of Water Affairs (DWA)[7] and Ministry of Agriculture and Livestock (MAL). This extends from the national level to the community level, and results in restricted interpretation and application by user-agencies and local communities.

7. Regarding technical capacity and access to Numerical Weather Prediction (NWP) and climate models, there are currently staffing shortages at ZMD. This restricts the ability to downscale forecasts and apply them to local conditions, and to use weather and climate forecasts on daily to seasonal timescalesfrom neighbouring countries or international centres. This limited capacity extends to the operation and maintenance of climate information and early warning equipment and systems in Zambia, including the capacity to: i) replace components of the observing networks when they fail; ii) manage and run any forecast models; iii) understand how users interpret data and design information packages that address these needs; and iv) be able to combine, manipulate and overlay different data to identify areas at risk. There is also insufficient use of satellite data. It is now common practice to utilize satellite imagery as a useful tool for monitoring areas where meteorological and hydrological monitoring stations do not exist, as well as for monitoring environmental variables to assess current and future risks, e.g. satellite-based vegetation monitoring to assess crop performance. Through the African Monitoring of the Environment for Sustainable Development (AMESD) Zambia Drought Watch project, a satellite receiving station allows the reception of data for the development of environmental information specific to Zambia. However, this information is not fully utilized or integrated into the climate information system because of limited technical resources to adequately manage the data.

8. As a result of the problems discussedabove, the current status of climate information and EWSs in Zambia, combined with climate variability and change, will severely undermine future social and economic development in Zambia.

## 1.2 Preferred solution

9. To allow Zambia to better manage food security, agricultural production andlimited water resources – and to build the climate resilience of socio-economic development – it is essential to:

- enhance the capacity of hydro-meteorological services and networks for predicting weather and climatic events and associated risks;
- develop a more effective, efficient and targeted delivery of weather and climate information including early warnings; and
- support improved and timely preparedness and response to forecast climate-related risks and vulnerabilities.

10. This will require the development of robust weather and climate observation, forecasting, and monitoring infrastructure which can be rapidly deployed, is relatively easy to maintain, and simple to

[7] The Department of Water Due Affairs (DWA), under the Ministry of Mines, Energy and Water Development, is due to be replaced by the Water Resources Management Authority (WRMA). This transition is scheduled for 2013. This document therefore refers to DWA/WRMA when referring to the current DWA.

use. Such a weather and climate information and monitoring system will provide ZMD with the opportunity to: i) developreal-time weather and hydrological monitoring capabilities; ii) improve weather forecasting capabilities,e.g. through the use of Numerical Weather Prediction; and iii) provide agro-meteorological information and services tailored to specific sectors and end-users. This information, provided through ZMD, will allow DMMU, DWA/WRMA, MAL and other associated departments/agencies to package the information and advisories for a range of other service providers including applications related to building and management of infrastructure, land and air transport, and the private sector. When warnings are required, based on the intepretation of the climate information, DMMU will be able to send these to vulnerable communities with adequate lead-time to allow preparation and risk reduction activities to occur. Ultimately, the weather and climate information and monitoring system will generate information that can be integrated into long-term planning and policy-making processes.

11. Generated weather and climate information needs to be clearly communicated to end-users through EWSs. There are four elements that make up an effective EWS: i) knowledge of risks and vulnerabilities; ii) monitoring and producing warnings; iii) disseminating warnings; and iv) capacity to respond to warnings. These elements need to be strongly inter-linked with effective communication between all sectors in order for the EWS to function.If any of these four elements are missing or limited, the function of the EWS as a whole is compromised. Previous EWSs in Zambia have failed to fulfil their purpose because of a lack of coordination in generating and disseminating the information, as well as key missing activities within all four elements of the EWS.

## 1.3 Barriers to the preferred solution

12. There are significant policy, institutional, financial, technological and informational **barriers** that prevent the preferred situation from emerging. These barriers include:

- *Inadequate weather and climate monitoring infrastructure, which limits data collection, analysis and provision of timely meteorological services.*

13. Historically, restricted public sector support has meant that the meteorological sector has been unable to procure and install the hard- and software required to effectively gather climate information in Zambia. As a result, the climate and weatherinformation system (including synoptic and agro-meteorological stations, satellite receivers and radar) in Zambia hasbeen operating using a limited number of weather observation stations that is insufficient for a country of Zambia's size and climate variability. The majority of the limited number of current meteorological stations are manually operated and feed information into a national system through Ultra High Frequency (UHF) radio, email and landline. This poses challenges in terms of providing real-time updates because the hazard has often already occurred by the time all information is gathered. ZMD has received support through various donor projects, but the budget for operations and maintenance is limited, meaning that current and newly installed equipment is poorly maintained or not properly installed. In addition, this support is not sufficient to procure enough stations to achieve the desired number of stations in Zambia. The current climate and weatherinformation infrastructure in Zambia is therefore not effective for early warning provision or climate change adaptation planning.

- *Limited knowledge and capacity to effectively project future climate events as a result of an acute shortage of technology and skilled human resources, as well as access to climate models and hardware.*

14. Zambia's scientific and technical capacity to effectively identify hazards and forecast their potential impacts on vulnerable communities is weak. This is largely a result of a lack of infrastructure (i.e. computational equipment), software (model code and associated routines), and human capacity/skills to program and run the software required to generate forecasts. Running forecast models is a highly skilled task and requires many years of education and training. Zambia's

meteorological service has approximately 160 staff, with approximately 50 at the head office in Lusaka and approximately 110 at meteorological stations and at provincial offices. There are approximately 95 staff in the forecasting division country-wide. The majority of staff in the forecasting division, however, has certificate-level training, which is insufficient to adequately perform the role expected of them. This means that there is a shortage of skilled forecasters and meteorologists. This problem is further compounded by high rate of staff turnover, as the skilled individuals who are employed at ZMD are often lured overseas or into more lucrative work.

- *Weak institutional coordination between institutions leading to limited packaging, translating and disseminating weather and climate information and warnings.*

15. According to the UNDP-supported report on the capacity for early warning services in Zambia written in 20108, there is no organisational mechanism between government, business and civil society for effective cross-sectoral early warning against climate variability and climate change in the country. All the organisations assessed in the report (100%, see Section 2.2, "Institutional framework" for the list) were found to be lacking proper organisational structures and capacity for effective weather and climate monitoring and/or early warning generation and dissemination. Adequate staffing was reported to be a major problem at all organizations, and appropriate mandates, policies, strategic plans and programmes were found to be lacking in over 90% of cases investigated. Operational capacity was reported to be lacking by all the respondent institutions and in all the following areas: i) technical knowledge; ii) skills and competencies; iii) physical infrastructure (equipment, ICT, transport etc.); and iv) management information systems. Furthermore, it was determined that there is a lack of clear definitions of concepts, terms and procedures for presenting risk and warning information and responsibilities in warning systems. This is mainly as a result of weak institutional arrangements, absence of policy and legal frameworks to guide the provision of meteorological services, and limited appreciation and use of meteorological services by other sectors of the economy.

16. Subsequent to the 2010 report referred to above, DMMU has started sending out warnings, however there is poor coordination between the ZMD, DWA/WRMA, MAL, DMMU, Ministry of Health (MoH) and Central Statistics Office (CSO) with regards to climate monitoring and early warning information sharing and information flow, as well as the mainstreaming of climate change across governmental sectors. Poor inter-sectoral coordination at a departmental and ministerial level results in the available climate, agriculture and environmental data and information not being adequately combined and/or translated for it to be easily understood by users. Furthermore, this results in limited agreements on official processes for sharing climate/weather and related environmental/socio-economic information, production of advisories, and issuing of subsequent warnings. This includes between sectoral departments and ministries and with communities where climate/weather hazards are predicted.

17. While DMMU is mandated to issue warnings, lack of co-ordination and information supply means that messages are confused between different sources and not acted upon. There needs to be an official process for generating warnings that includes communication between disaster-affected communities and sectoral ministries including DMMU, ZMD, DWA/WRMA and MAL. Representatives from different ministries should convene in order to assess the current situation and convey appropriate warning messages accordingly. This occurs on an ad hoc basis at present, but no formal collaboration agreements exist. Calculating risks for known vulnerabilities requires a comprehensive archive of information related to inter alia vulnerable communities, infrastructure, roads, accessibility of markets, location of flood-prone areas, and cropping patterns. Meteorological information is currently housed at ZMD, and hydrological information at DWA/WRMA, with data also held within the World Food Programme (WFP) andother disconnected databases or computers spread across different government departments and ministries. All the information required to assess

[8]Sinkamba, F., Sinyangwe, B. and Chipeta, G. 2010. Report on the assessment of the National Capacity for Cross-Sectoral Early Warning Services against Climate Variability and Climate Change.

vulnerability and calculate risks needs to be accessible through a central database/repository or through distributed networks in order to maximise its effective use.

- *Long-term sustainability of observational infrastructure and technically skilled human resources is compromised because of inadequate Government of the Republic of Zambia(GRZ) and private sector funding.*

18. The maintenance of monitoring equipment and human capacity to use and repair this equipment, process data and develop early warning packages requires constant budgetary allocations. These are needed beyond the lifetime of any given project and therefore require the development of suitable business models and financial mechanisms to generate income to cover these recurrent costs. Institutions such as ZMD, DWA and MAL are not allocated sufficient Operation and Maintenance budgets, and struggle to pay for the maintenance and upgrade of existing equipment. This results in limited certainty that the required annual activities to ensure the continuity and integrity of infrastructure investments will be undertaken.

19. This is recognized as a limiting factor to the establishment of an effective hydro-meteorological monitoring and forecasting network9. While there is limited private sector involvement in climate change adaptation activities in Zambia at present, there are on-going initiatives attempting to catalyze a private sector interest (see Section 2.4, Outcome 2, "Associated baseline projects"). There is a need to identify private sector demand for hydro-meteorological services to inform the development of relevant products as well as marketing strategies for these products. This revenue can then help (through funds additional to GRZ budgets) support the maintenance of the observational infrastructure and the salaries of skilled staff to operate the observational network and generate climate/weather information and associated early warning products.

## 2. STRATEGY

20. ThisLeast Developed Country Fund (LDCF) project will contribute to overcoming the above identified barriers byimproving national capabilities to generate and use weather/climate information in the planning for and management of climate-induced hazards. It will achieve this by implementing the transfer of appropriate technology, infrastructure and skills tohydro-meteorological services (ZMD and DWA/WRMA), user-agencies (DMMU, MAL, MoH and CSO) and end-users (local communities) in the country. This will contribute to the preferred solution by enhancing capacity to operate and maintain a climate observation network and use the resultant data to generate tailored, sector-specific information, as well asdevelop an efficient delivery system for the timely dissemination of early warnings and collect long-term observations for adaptation planning.

### 2.1 Project rationale and policy conformity

*2.1.1 Consistency with national priorities*

21. The LDCF project responds to priority adaptation needs and actions identified in Zambia's NAPA[10,11], specifically Option 2: "Strengthening of early warning systems to improve services to

[9] For further information see WMO Global Framework for Climate Services.

[10] In implementing priority interventions identified in Zambia's NAPAs, the project is consistent with the Conference of Parties (COP-9) and satisfies criteria outlined in UNFCCC Decision 7/CP.7 and GEF/C.28/18. The project focus is aligned with the scope of expected interventions as articulated in the LDCF programming paper and decision 5/CP.9 and LDCF updated operational guidelines GEF/LDCF.SCCF.13/04. As climate impacts fall disproportionately on the poor, the project recognizes the links between adaptation and poverty reduction (GEF/C.28/18, 1(b), 29).

[11] The process for developing NAPAs is highly consultative and the prioritization process relies on the following criteria (as per Decision 28/CP.7):"Criteria for selecting priority activities. A set of locally-driven criteria will be used to select priority

preparedness and adaptation to climate change"[12]. The objectives as stated in the NAPA are: i) strengthening systematic observations of meteorological and hydrological services, and capacity building, education and public awareness; and ii) developing the use of compatible standards and systems – encompassing relevant data and stations – including remote areas, and use and disseminate modern technology for data collection, transmission and assessment. This includes the need to: i) develop infrastructure for early warning advanced planning purposes; ii) establish a National Climate Centre; iii) collect the required climate, environmental and health data; iv) conduct field surveys in representative localities to identify climatic and non-climatic disease risk factors; v) establish an effective climate data management system; vi) develop human capacity for regular monitoring of climate stations for data quality; and vii) devise an effective information dissemination process to all sectors that may be affected by climate change.

22. The LDCF project is aligned with the framework of *Poverty Reduction Strategy Paper* (PRSP 2002-2004), of which the relevant pillars are *Governance* (improved security, including security from natural disaster) and *Agriculture* (technology development and food security efforts). The PRSP was succeeded by the *Fifth and Sixth National Development Plans* (FNDP, 2006-2010; SNDP, 2011-2015). A large proportion of the development fostered by these strategies focuses on the development of climate change adaptation programmes. It is acknowledged, however, that appropriate climate information is lacking. With regard to meteorology, which is included in the Information and Communications Technology sector, there is a focus on enhancing the capacity of the sector to provide timely and accurate information for the public to respond and adapt to climatic events. Other sectors being further developed by the PRSP and FNDP include the agriculture infrastructure, education, health, tourism and mining sectors.

23. Other policies of relevance include the *National Disaster Management Act* (2010), *National Disaster Management Policy* (NDMP, 2005),the *National Meteorological Policy* (NMP, 2009) and the *National Agricultural Policy* (NAP, 2004-2015). The NDMP was put in place in an effort to respond to local, regional and national disasters related to flooding, drought and other climatic hazards. The NDMP is currently under revisions, which will include the addition of Disaster Risk Reduction (DRR) activities to enable a trnasition from re-active to pro-active disaster managemet.The NMP covers climate variability, climate change and meteorological data acquisition and management. The aim of this policy is to guide and direct the provision of meteorological services, utilisation of weather climate information, development of a model legal framework, and establishment of a semi-autonomous meteorological agency. The purpose of Zambia's NAP is to enhance agricultural productivity and thereby reduce poverty by means of *inter alia* capacity building, sustainable agricultural practices, soil conservation measures and increasing the extent of irrigated agriculture. These objectives should be informed by the appropriate agro-meteorological data and early warnings.

24. The *National Environment Policy* (NEP, 2004) identifies 11 government ministries involved in environmental affairs[13]. Nine of these ministries have policies that include environmental matters (nineteen policies in total). The draft NEP also highlights current shortfalls in these nineteen policies including ineffectual mechanisms for community-based natural resources management, lack of informal inter-sectoral links, limited up-to-date baseline data and limited national guidelines for effective integration of international environmental conventions[14]. In addition, intra- and inter-sectoral

adaptation activities. These criteria should include, inter alia: a) Level or degree of adverse effects of climate change; b) Poverty reduction to enhance adaptive capacity; c) Synergy with other multilateral environmental agreements; and d) Cost-effectiveness. These criteria for prioritization will be applied to, *inter alia*: a) Loss of life and livelihood; b) Human health; c) Food security and agriculture; d) Water availability, quality and accessibility; e) Essential infrastructure; f) Cultural heritage; g) Biological diversity; h) Land-use management and forestry; i) Other environmental amenities; and j) Coastal zones, and associated loss of land."

[12]NAPA Option 1: "Adaptation of the Effects of Drought in the context of Climate Change in Agro-Ecological Region I of Zambia" is being implemented through a separate UNDP LDCF-funded project.

[13] These ministries are: Finance and National Planning; MAL; Mines and Mineral Development; Health; Education; Local Government and Housing' Tourism, Environment and Natural Resources; Community Development; Lands; and the Cabinet Office.

[14]NEP (2004).

institutional arrangements are limited and few coordination mechanisms exist for effective multi-sectoral integration of adaptation into such legislation.

25. Zambia has a *Gender Policy* which was adopted in 2000. This policy recognizes the disparity that exists between men and women, where women remain a disadvantaged and more vulnerable group. The policy advocates gender equality and women's empowerment in all sectors. This is also captured in the SNDP where gender concerns are regarded as a sectoral as well as a cross-cutting issue.

26. Although climate change is likely to have serious negative impacts on Zambia's ability to meet its development targets as outlined in the SNDP and attain the Millennium Development Goals (MDGs), climate change has not been fully integrated into any of the abovementioned policies apart from the SNDP and the National Climate Change Response Stategy (under development). The policies, however, do acknowledge that present climatic variability is largely responsible for many challenges faced in Zambia, including food, water and health insecurity. As a result of this acknowledgement, most of the policies emphasise the need for an improved EWS that is effective at a local level. As a result of the lack of consideration of climate change impacts, the policies' mitigation and development strategies are likely to be less effective and potentially maladaptive in the future.

### *2.1.2 Consistency with objective and priorities of the LDCF*

27. The LDCF project has been developed using the GEF Updated Results-Based Management Framework for the LDCF/SCCF and the Adaptation Monitoring and Assessment Tool (AMAT,GEF/LDCF.SCCF.9/Inf.4). The project is aligned with Climate Change Adaptation (CCA) objective 2 "Increase adaptive capacity to respond to the impacts of climate change, including variability, at local, national, regional and global level".Specifically, it relates to the following outcomes: 2.1) increased knowledge and understanding of climate variability and change-induced risks at country level and in targeted vulnerable areas; and 2.2) strengthened adaptive capacity to reduce risks to climate-induced economic losses.

28. In line with the LDCF eligibility criteria and priorities, the LDCF project will use LDCF resources to finance the additional costs needed for increasing the climate change resilience of the baseline situation concerning the generation of climate data and associated early warnings in Zambia. It will build on Zambia's existing climate information, forecasting and EWSnetworks to safeguard lives and livelihoods from the impacts of an increase in frequency and intensity of severe weather events, in particular floods and droughts. In line with the LDCF guidelines, the LDCF project has been developed and will be implemented using the following approaches: i) participatory; ii) learning-by-doing; iii) multi-disciplinary; iv) complementary; and v) gender sensitive.

- Patricipatory: A National Consultant undertook numerous consultations with all key representatives of the project from January to April 2013, and three in-country missions were undertaken by the International Consultant (09-14 September 2012, 5-15 December 2012 and 28April – 3 May 2013) while the project was in the development (PPG) phase. See "Stakeholder baseline analysis" for further information.
- Supporting a "learning-by-doing" approach:Community-based EWSs will test the cost effectiveness of different approaches to disseminating a range of warnings to generate understanding of climate change adaptation and how long-term development planning could best be supported across the economy. This information will be used to faciliate policy and budgetary adjustments.
- Multi-disciplinary: The LDCF project will improve the availability and accuracy of meteorological data, but also the uptake of this data by other sectors including agriculture, water and health. This data will be used in planning purposes and also in the generation of short- and long-term warnings, issued to vulnerable communities through communication channels established through the project. The LDCF project will therefore have a meteorological focus, but

will involve many planning activities that will build the climate resilience of vulnerable sectors and communities.

- Complementary: The LDCF project will build on a number of baseline projects, which are providing a total co-financing amount of US$ 23,531,947. See Sections 2.3 and 2.4 for more detailed description of the baseline projects the LDCF project will complement. The LDCF project is designed to accommodate the additional adaptation costs associated with these baseline projects, which have been identified through in-country stakeholder consultations.
- Gender sensitive: The demonstration sites where the community-based EWSs will be established were selected based on a gender sensitive vulnerability analysis. The LDCF project will therefore target communities in districts with the most vulnerable women populations. In Zambia, women make up the majority of smallholder farmers and are the most vulnerable demographic group to food insecurity. The provision of agricultural information informed by climate data will therefore be of great benefit to women, particularly in the demonstration sites, but also throughout Zambia.

29. Furthermore, the LDCF project focus is aligned with the scope of expected interventions as articulated in the LDCF programming paper and decision 5/CP.9. As climate impacts fall disproportionately on the poor, the project recognizes the links between adaptation and poverty reduction (GEF/C.28/18, 1(b), 29).

## 2.2 Country ownership: country eligibility and country drivenness

30. As a Least Developed Country (LDC) and a Landlocked Developing Country (LLDC)[15], Zambia recognizes that it has limited resources to effectively lower the risks that climate change poses to hard-won development gains. As a result, the government is making efforts to address climate change and is committed to ensuring that the poorest and most vulnerable communities are supported by programmes that enhance their long-term adaptive capacity. Zambiasigned the United Nations Framework Convention on Climate Change (UNFCCC) in 1992, and ratified the UNFCCC and the Kyoto Protocol (KP) in 1993 and 2006, respectively, as a non-Annex 1 country. By signing and ratifying both the UNFCCC and KP, the government has committed to the adoption and implementation of policies and measures designed to adapt to climate change. As a result, a number of activities have been undertaken (detailed below), which the LDCF project will build upon and complement.

- National Communications. The Resubmitted the Initial National Communication (INC) to the UNFCCC in 2004, which included a national greenhouse gas (GHG) inventory system, an assessment of the country's status of vulnerability and adaptation to climate change, and recommendations for adapting to and mitigating climate change. At present, the government is in the process of preparing the Second National Communication (SNC). The SNC will also serve as a management tool, as well as indicating the gaps in the current national capacity to address climate change.
- National Adaptation Programme of Action (NAPA). The Ministry of Tourism, Environment and Natural Resources (MTENR) prepared the NAPA to specifically identify and highlight urgent adaptation intervention targeting selected vulnerable groups (such as small-scale farmers, the poor, women and children) that require implementation in Zambia. It was submitted in October 2007. The NAPA includes a list of ten priority projects, many of which are yet to be rolled out and implemented. In implementing priority interventions identified in the NAPA, the project is consistent with the ninth Conference of Parties (COP-9) and also satisfies criteria outlined in UNFCCC Decision 7/CP.7 and GEF/C.28/18.
- Climate change awareness campaign. The government has undertaken a comprehensive national climate change awareness campaign in line with the commitments originating from their

[15] "Landlocked developing countries are generally among the poorest of the developing countries, with the weakest growth rates, and are typically heavily dependent on a very limited number of commodities for their export earnings." UN Office of the High Representative for the Least Developed Countries, Landlocked Developing Countries and Small Island Developing States. (http://www.un.org/special-rep/ohrlls/lldc/default.htm).

UNFCCC membership. The objective of the campaign is to ensure national ownership and the success of future climate change-related efforts, through sensitization of stakeholders and national consensus building.

- National Capacity Self-Assessment (NCSA). The NCSA was completed in 2007 to assist in the implementation of the Rio Convention. The assessment identifies the national capacity and development gaps hindering the effective implementation of the United Nations Conventions on biodiversity (UNCBD), and to combat desertification (UNCCD) and climate change (UNFCCC), and proposes a strategy and an action plan to address such gaps, in the short- and long-term.

31. To develop a project that reflects the needs of national stakeholders– i.e. to ensure country drivenness – and to instil a feeling of country ownership of the project, the LDCF project is based on information received from a range of stakeholder consultations conducted in Zambia from September 2012 to April 2013(see "Stakeholder baseline analysis", below).In addition, the LDCF projectis linked to priorities reflected in theUN Development Assistance Framework (UNDAF), including the following Country Programme outcomes: 2.1) Government and partners enable vulnerable populations to be food secure by 2015; 4.1) Disaster Management and Mitigation Unit (DMMU) has a fully functional national disaster management and early warning system to prevent, alert and respond to disasters by 2015; 4.2) Government promotes adaptation and provide mitigation measures to protect livelihoods from climate change; and 4.3) Government implements policies and legal frameworks for sustainable community based natural resources management.Further, in line with UNDP policy, this LDCF project will be implemented under the National Implementation Modality.

### *2.2.1 Institutional framework*

32. An overview of the institutional framework of disseminatorsof early warning services at national, institutional and district level is provided below.

33. At the national level, DMMU is the vehicle that coordinates the cross-sectoral early warning institutions through its National Disaster Management Technical Committee (NDMTC) on early warning, with its broad functions outlined in the National Disaster Management Policy. The existing institutional framework in DMMU is composed of the Provincial (PDMC), District (DDMC) and Satellite Disaster Management Committees (SDMC). While the mandates of these committees– under the National Disaster Management Committee (NDMC) as directed by the National Meteorological Act –includes the consolidation and disseminating of early warnings, this issue will be given more prominence through the LDCF project. This will be achieved by developing human technical capacity of the members of the committees composed of early warning providers and climatically vulnerable sectors such as agriculture, water and energy and health. This membership to DMMU structuresis stipulated in the National Disaster Management Policy and Act, however the structure currently does not mainstream early warning against climate variability and change.

34. The following institutions will be incorporated into the institutional framework, through the NDMTC[16]:

- ZMD collects climate data and provides related services and products to the public and various stakeholders whose operations are sensitive to weather and climate. There are many stakeholders who require weather and climate information, the notable ones being aviation, agriculture, water resources management, education and research, health, and building and civil engineering. Some of the users need the weather and climate information to generate their sectoral early warning services and products. The products provided by ZMD are detailed in Section 2.4.
- MAL is the national focal point for early warnings on food security. It has structures for the collection, processing, analysis and dissemination of the information that enables stakeholders at all levels to make informed decisions on what programs to undertake in the area of food security.

[16]Sinkamba, F., Sinyangwe, B. and Chipeta, G. 2010. Report on the assessment of the National Capacity for Cross-Sectoral Early Warning Services against Climate Variability and Climate Change.

More information on the specific climate requirements and early warning services offered by MAL is provided in Section 2.4.

- DWA is the focal point for water affairs development in the country, and operates within the Ministry of Energy and Water Development (MEWD). It is a member of the NDMTC Subcommittee on Health, Water, Sanitation and Nutrition and the Subcommittee on Early Warning System. DWA requires weather and climate data and information as an essential input for carrying out its mandate. DWA is due to be replaced by the WRMA.
- MoH has a well-established Early Warning System for Disease and Epidemics from the Health Centres to Ministry Headquarters. It has an established Health Management Information System which captures Diseases and Epidemics information in the country. The early warning structures operate in tandem with the fight against poor health, which involves mounting preventative and curative measures against other diseases like malaria and cholera whose incidence is determined by weather patterns. The current early warning system, however, does not take climate-related information into account.
- CSO is a department under the Ministry of Finance and National Planning (MFNP). In early warning provision, it is a member of the National Early Warning for food security spearheaded by MAL. The CSO – through its Agriculture and Environment Statistics Division – conducts various surveys, which are further detailed in Section 2.4.

35. The following institutions are focussed on climate change considerations, and are thus relevant to institutional framework of the LDCF project:

- Interim National Climate Change Secretariat (INCCS). At the time of the LDCF project development a decision had been made to establish an Interim-Ministerial Secretariat. To constitute the Secretariat, staff was seconded from Department of Environment and Natural Resources (adaptation and mitigation), ZMD (climate data), MAL (adaptation), Ministry of Transport, Works, Supply and Communication (infrastructure) and DMMU (climate information and early warning system). The Secretariat will report to the Committee of Permanent Secretaries and will work closely with appropriate ministries that will be responsible for implementing programs related to climate change.

### *2.2.2 Stakeholder baseline analysis*

36. Multi-stakeholder consultationswere conducted to inform the design of the LDCF project. These included: i) an initial consultation mission (9-14 September 2012), including an inception workshop on 11 September 2012; ii) a series of stakeholder consultations from 5-14 December 2012; and iii) a validation mission and series of consultations (28 April – 3 May 2013), including a validation workshop on 2 May2013.

37. Workshops were attended by national operational focal points and government departments responsible for generating and using climate information and early warning systems, as well as a number of development partners, NGOs and civil society organisations. Bi-lateral stakeholder consultations included a range of additional meetings that were held between September 2012 and April 2013 with bi-lateral and multi-lateral organisations, government departments and NGOs, as well as private sector partners. All consultations were conducted by the international consultant and/or the national consultant with support from the UNDP Country Office (CO). The Implementing Partner (IP) and Responsible Partners (RPs) played a considerable role in determining the activities for the LDCF project and were involved in most of the consultations. Furthermore, the UNFCCC operational focal point was involved in the project design through emails and consultations.

38. Details of stakeholder consultations – including reports, programmes and participant lists – are included in Annex 1. The Inception Report from the initial mission is included as Annex 2 Details of stakeholder involvement during the project implementation phase are provided in Section 2.9.

## 2.3 Design principles and strategic considerations

39. This LDCF project will be implemented as part of a broad multi-country programme that will implement similar initiatives on climate information and Early Warning Systems in at least 10 countries in Africa (including Benin, Burkina Faso, Ethiopia, Liberia, Malawi, Sierra Leone, São Tomé & Príncipe, Tanzania, Uganda and Zambia). These individual country projects have been developed through a multi-country approach with a view to aligning regional priorities and identifying opportunities to increase knowledge sharing.

40. In all project countries, upgrades and rehabilitation of the hydro-meteorological monitoring network will be complemented by providing local stakeholders with training and capacity-building in operation and maintenance of the improved infrastructure (Output 1.3). In Zambia, this will include the development of a climate observation quality control and maintenance toolbox (including remotely accessible and online calibration and training courses, handbooks and manuals for AWSs and manual stations) and an awareness campaign on the importance/benefits of the installed equipment. Similar toolboxes are being developed in other countries, such as Uganda and Malawi, and the content of the toolboxes can be aligned. In addition, project countries will be provided with training and capacity-building for modeling and forecasting climate and weather. They will also be generating tailored climate information packages and sector-specific Early Warnings (Outputs 1.4, 2.1 and 2.3). It is anticipated that there will be considerable scope for much of these training and capacity-building activities to be undertaken in coordination with other project countries.

41. All 10 LDCF African EWS projects will include activities, which will require considerable technical support in specialized applications related to the design and implementation of standard operating procedures and tailored warnings/advisories, and the communication of advisories/warnings (Outputs 2.1 and 2.3). The appointment of suitably qualified technical staff to provide technical support to all project countries, including Zambia, will reduce the budget and time allocated to hiring and training. It will also improve the coordination and standardization of activities between all project countries. In addition, all project countries will benefit from shared information, lessons learned and identified best-practices. For example, the training of senior climatologists, analysts, weather forecasters and researchers (Output 1.4 for Zambia) to produce forecasts and develop tailored hydro-meteorological information can be undertaken through regional workshops, as this is a training requirement of most countries. This will allow all project countries to share costs such as workshop facilities and accommodation, hiring technically skilled trainers and purchasing/developing appropriate training materials.

42. By strengthening ties and collaboration between regional stakeholders, the individual projects will benefit from sharing relevant data and information packages (for example, in the case of shared watersheds and river systems). Stakeholders in Zambia who can benefit from participating in regionally-aligned training and workshops include ZMD, DMMU, DWA/WRMA, MAL and MoH. Relevant national sector policies, strategies and plans – which will be strengthened through regionally-aligned workshops and training activities – will include the National Development Plan and Disaster Management Policy. The development of standardized processes for disseminating flood, drought, health and other climate-related warnings through DMMU in Output 2.1 (and specifically in the priority districts of Chipata, Gwembe and Sesheke in Output 2.3) will be enhanced by sharing knowledge, experiences and best-practices between all project countries participating in regionally-aligned activities. In the case of the Zambia project, protocols and agreements for strengthening interactions and coordination between ZMD, DMMU, DWA/WRMA and MAL – including those related to the sharing of hydro-meteorological information/data – will be enhanced by including experiences from other countries, particularly those neighbouring Zambia i.e. Malawi and Tanzania.

43. All of the above-mentioned African climate and Early Warning Systems projects will include an output that will develop a sustainable financing strategy for ongoing operation and maintenance of the newly enhanced hydro-meteorological networks. These may include leveraging financing and

logistic support from private sector companies and relevant socio-economic sectors, notably agriculture and telecommunications (Output 2.4). Wherever possible, activities (which include establishing public-private partnerships in various project countries, such as between ZMD Instrument Division and private sector agricultural insurers in Zambia) will be coordinated to assist participating private sector companies to engage efficiently and cost-effectively with the LDCF projects in the different countries. This will also simultaneously improve the negotiating position of each individual government. Further details on the cost-effectiveness benefits of this approach are provided in section 2.6.

### *2.3.1 Baseline projects and related on-going initiatives*

44. The LDCF project is focused on strengthening the capacity of national and sub-national entities to monitor climate change, generate reliable climate and meteorological information, and be able to combine this information with other environmental and socio-economic data to improve evidence-based decision-making for early warning and planning adaptation responses.

45. To ensure that LDCF funds are used in a strategic manner, the LDCF project aims to build upon existing climate and weather information (including monitoring) and EWS-related activities implemented by both government, multi- and bi-lateral donors, and NGOs. This includes coordinating with climate and weather information gathering and EWS efforts in the country and strengthening the national framework for EWS implementation. Specifically, the LDCF project will finance the additional adaptation costs of priority actions not currently funded by the baseline projects, described below. Table 1 indicates each of the specific baseline projects and the indicative co-financing amounts. See Annex 3 for co-financing letters from each of the baseline projects.

**Table 1**: Specific baseline projects and indicative co-financing amounts.

| **Funding source** | **US$** |
|---|---|
| **Co-financing sources** | |
| Southern Africa Science Service Centre for Climate Change and Adaptive Land Management (SASSCAL) project – *Expand, modernize and improve weather observation network; improve forecasting in Zambia*. | 785,000 |
| World Bank (WB) – Water Resources Development Project | 8,000,000 |
| Government of the Republic of Zambia (GRZ) / UN Joint Programme on Climate Change And Disaster Reduction. | 1,000,000 |
| GRZ, Zambia Meteorological Department (ZMD) budget allocation | 1,290,720 |
| GRZ, Disaster Management and Mitigation Unit (DMMU) budget allocation | 2,456,227 |
| **Least Developed Country Fund (LDCF) project grant requested** | 3,600,000 |
| **Total** | **17,131,947** |

46. A description of the baseline projects upon which Outcome 1 will build(see Section 2.4) is provided below.

47. The **Southern Africa Science Service Centre for Climate Change and Adaptive Land Management (SASSCAL)**project (2010 – on-going) is funded by the German Federal Ministry of Education and Research.It is a regional project involving five South African Development Community (SADC) countries – Angola, Botswana, Namibia, South Africa and Zambia. The focus is on research and capacity development. The aim of the project is to develop capacities to provide sound science-based solutions for current problems and future risks in the SADC region, in particular regarding climate change and the associated land management demands. In so doing, SASSCAL will contribute to strengthening existing and developing new capacities for application-oriented scientific research and science-policy consultations on climate change, adapted land-use and sustainable development in the region.

48. In Zambia, the project will be co-ordinated through ZMDby the Ministry of Education, Science, Vocational Traiing and Early Child Education. Resources will be dedicated to improving

weather forecasting and early warning, by"*expanding, modernizing and improvingthe weather observation network, to improve forecasting in Zambia*". This includes the provision of 10 AWSs to be installed by ZMD, as well as fellowship support for staff tarining at undergraduate and diploma level in meteorology, climatology, engineering, and information and communication technology.

49. The **World Bank (WB)**-led Water Resource Development Project will enhance the water resource management capacity of Zambia at national and regional levels. In addition to water resource management (~US$ 16 million), the project will also dedicate resources towards improving hydrological infrastructure (~US$ 22 million) and providing institutional support (~US$ 12 million). Activities relevant to the LDCF project include: i) re-enforcing the hydro-meteorological and groundwater monitoring network; ii) strengthening the national hydrological and geo-hydrological information management systems and improved decision support tools; iii) developing flood forecasting and associated early warning systems; iv) preparing consolidated basin-level water resources development plans and strategic assessment; and v) implementing arrangements and measures for water resource allocation and management. This will be achieved through the provision of both technical and financial (investment in goods, equipment and vehicles) assistance.

50. A description of the baseline projects upon which Outcome 2 (see Section 2.4) will build is provided below.

51. **Government of the Republic of Zambia (GRZ) / UN Joint Programme on Climate Change and Disaster Risk Reduction.** As part of the UNDAF, and within the context of delivering as "One UN", the UN in Zambia in cooperation with the GRZ has developed a Joint Programme with the objective of developing capacity and increasing investments at national and local levels for an effective multi-sectoral and multi-level response to climate change. The Joint Programme brings together seven agencies – FAO, UN-HABITAT, UNDP, UNICEF, UNIDO, WFP and the Global Mechanism of the UNCCD – which have complementary competencies to address gaps in the long-termclimate change response in Zambia. The Joint Programme has two pillars dealing with: i) capacity development; and ii) climate change response investments.

52. The capacity development pillar is targeted at: i) supporting the development of revised and harmonized policy, legal and regulatory frameworks for climate change and disaster risk reduction coordination in five priority sectors, namely agriculture, forestry, energy, industry and water; ii) developing institutional capacity to stimulate greening of the economy in the five priority sectors; iii) strengthening capacities for effective implementation of Zambia's policies, strategies and programmes on climate change and early warning, i.e. NAPA, draft NCCRS, CRLED programme, REDD+, NAMA and National Adaptation Programmes; iv) improving government's capacity to access, utilize and report on finances applied to climate change adaptation and mitigation; and v) improving climate change responses and early warning systems in the five priority sectors.

53. The climate change response investment pillar is targeted at increasing investments in adaptation and mitigation responses in the same five priority sectors, as outlined in the NAPA and draft NCCRS. Special attention will also be dedicated to urban issues, including transport, energy, water, and urban planning and infrastructure development.

54. A description of the related, on-going initiatives to which the LDCF project will link to is provided below.

55. The **Gesellschaft für Internationale Zusammenarbeit (GIZ)** in collaboration with the **German Investment Bank (KFW)** is implementing a project to strengthen the management of Zambia's water sector. The aim of the project is to improve: i) collection; ii) processing; iii) management; iv) and utilisation of hydrological data in Zambia. This will allow for the improvement of water resources planning and management. The required information systems will be hosted by the

Water Resources Management Authority (WRMA), which will replace the DWA. The required capacity will be built/developed through GIZ and KfW funding. A new information system will be developed – an Integrated Water Resource Management Information System (IWRMIS) – that will include a framework that can accept data from any database,i.e. from DWA, Zambia Electricity Supply Corporation Limited (ZESCO), Zambezi River Authority (ZRA), ZMD, MAL and CSO. The IWRMIS will assist in theintegration of climate change considerations into water resource management. Data sharing arangements between all parties are expected to be agreed upon in 2013/2014.

56. The GIZ/KfW project will have a dual focus:

- Financial investments for the rehabilitation and expansion of the existing hydrological measuring network, IT infrastructure, and investments in the physical work environment of the operating institutions. This will include priority and secondary financial investments.
- Investments in the development of organizations and organizational change, and development of staff members' skills through technical cooperation measures.

57. The planned physical investments comprise of:

- Structural rehabilitation and instrumentation of 168 water level gauging stations:
  - 58 first priority stations will be equipped with continuous recorders, staff gauges, rainfall recorders and automatic data transmission facilities through Global System for Mobile Communication (GSM)/General Packet Radio System (GPRS); and
  - 110 second priority stations will be equipped with staff gauges and standard rainfall gauges.

58. The focus of the project will be the upper Kafue Sub-basin, as directed by the GRZ. Particular investments in the meteorological sector include: i) procurement of 200 rainfall gauges for volunteer stations in the Kafue Sub-basin; ii) installation of the IT infrastructure, which will include the improvement of connectivity to the internet, data transmission facilities at the hydrological and meteorological stations, and training; and iii) procurement of one vehicle for ZMD, in addition to the five vehicles for WRMA and potential catchment councils.

59. **Pilot Programme for Climate Resilience (PPCR).** Zambia is one of nine countries in which the PPCR is being implemented[17]. Selection for participation in the PPCR was made by an Expert Group on the basis of risk and vulnerability profiles, and the capacity to integrate climate resilience into development planning and sector policies, as well as to promote the scaling-up of activities to achieve greater climate resilience.

60. Zambia's PPCR goal is to mainstream climate change into the most vulnerable sectors of the economy, in order to ensure sustainable economic development towards the attainment of the country's Vision 2030. The PPCR has been led and coordinated by the Ministry of Finance and National Planning (MoFNP), and involves two phases:

- Phase I, the objective of which was to formulate Zambia's Strategic Programme for Climate Resilience (SPCR). It involved five strategic components: i) mainstreaming climate resilience into national development planning[18]; ii) strengthening institutional coordination; iii) improving information for decision makers; iv) targeting awareness and communication; and v) preparing for Phase II. This phase is expected to run from 2010 to mid-2013.
- Phase II will focus on implementing the SPCR along three major strategic components: i) participatory adaptation; ii) climate resilient infrastructure; and iii) strategic programme support. This phase is expected to run from mid-2013 to 2020.

[17] The others are: Bangladesh, Bolivia, Kingdom of Cambodia, Republic of Mozambique, Nepal, Republic of Niger, Yemen and Tajikistan, in addition to two regional Programmes in the Caribbean (Dominica Grenada Haiti Jamaica Saint Lucia Saint Vincent and the Grenadines) and the Pacific (Papua New Guinea, Tonga and Samoa.

[18] For the purposes of the Zambia PPCR, mainstreaming climate resilience into national economic planning means integrating and/or increasing budgetary allocations to Programmes and projects that promote climate resilience (e.g. agriculture diversification, develop risk management and vulnerability plans).

61. Given the high level of stakeholder interest on Zambia's Climate Change Programme, the critical need to build strong national capacity, and the risk of falling back on a business-as-usual model, the SPCR has chosen to support three dedicated (stand-alone) and well-coordinated investments:

- Strengthening Climate Resilience in Zambia and the Barotse Sub-Basin: this is being implemented through WB and will provide strategic support to Zambia's Climate Change Programme, while implementing participatory adaptation and climate resilient infrastructure in the Barotse Sub-basin of the Zambezi.
- Strengthening Climate Resilience in the Kafue River Basin: this is being implemented through AfDB and will focus on participatory adaptation and climate-resilient infrastructure in the Kafue Sub-basin of the Zambezi.
- Private Sector Support to Climate Resilience: this is being implemented through the WB by the International Finance Corporation (IFC) and will focus on priority private sector support to the two sub-basins in the areas of micro-finance, index-weather insurance, and information (ICT) support.

62. **GEF-LDCF Agriculture project.** UNDP is the Implementing Agency on the LDCF-funded project entitled "Adaptation to the effects of drought and climate change in Agro-ecological Regions I and II", for which MAL is the Implementing Partner. To reduce the vulnerability of communities in AER I and II to climate change impacts, the LDCF agriculture project will take a two pronged-approach: i) mainstream adaptation into agricultural planning at national, district and community levels to make the case for increased investment in adaptation in the agricultural sector; and ii) test and evaluate the adaptation value of interventions that protect and improve agricultural incomes from the effects of climate change. Capacity and systems to anticipate assess and prepare for climate change risks will be developed at community, regional and national levels. Adaptation learning generated from the pilot projects will be used to guide mainstreaming of adaptation in national fiscal, regulatory and development policies, to support adaptive practices on a wider scale. The following four outcomes will be delivered by the project:

- Climate change risks integrated into critical decision-making processes for agricultural management at the local, sub-national and national levels.
- Agricultural productivity in the pilot sites made resilient to the anticipated impacts of climate change.
- National fiscal, regulatory and development policy revised to promote adaptation responses in the agricultural sector.
- Knowledge and lessons learned to support implementation of adaptation measures compiled and disseminated.

63. The LDCF agriculture project includes developing effective agriculture-based EWSs for 8 priority districts, and the installation of agro-meteorological monitoring stations and associated communication channels. The eight priority sites are:

- Western Province: Kataba (Senanga District) and Sioma (comprising two closely situated villages, Kabula II and Kandiyana, in the Shangombo District).
- Southern Province: Kasaya Catchment (Kazungula District) and Lusitu Catchment (Siavonga District).
- Eastern Province: Mundalanga-N'ganjo (comprising two closely situated villages, Mundalanga and N'ganjo, in the Chama District) and Chikowa (Mambwe District).

64. The project managers of the LDCF agriculture project and present LDCF project will work closely together to ensure synergies are created and lessons learned from the one project are applied to the other. Information generated through the LDCF agriculture project will be used in the generation of agricultyre-specific forecasts and used to inform warnings, disseminated through the channels strengthened through the present LDCF project, when applicable.

65. **"Radio and Internet" (RANET) Programme.** Whilst not a baseline project for the LDCF project, because lack of available funds to act as co-finance, the LDCF project will build on the achievements of ZMD's RANET Programme. RANET aims to improve the delivery of information on agriculture, education, health, environment, weather, forecasted severe events and other vital developmental information to rural communities. This is achieved by assisting rural communities to partner with local FM broadcasting stations and by helping them to establish community broadcasting stations so that the information can be disseminated in local languages. The primary objective of RANET is to enhance the living standards of rural communities by improving the food security base and general well-being.

66. To date, RANET Zambia has established partnerships with the following radio stations: i) Radio Chikaya; ii) PASME Radio; iii) Kafue FM; iv) Chongwe Community Radio; v) Radio Mano of Kasama; vi) Radio Mazabuka; vii) Radio Maranatha of Kabwe; viii) Mkushi Community Radio; ix) Radio Yangeni of Mansa; x) Oblate Radio Liselion Mongi; xi) Radio Lyambai of Mongu; xii) Radio Maria of Chipata; xiii) Breeze FM in Chipata; xiv) IsokaCommunity Radio; xv) Mwinilunga Community Radio; and xvi) Radio FCC of Solwezi. RANET is in the process of establishing partnerships with: i) Kariba Radio in Sinazongwe District; ii) Kalabo Community Radio in Sesheke District; and iii) Radio Inyambo in Sesheke District. RANET is also connected by internet to the existing commercial radio stations, bringing the total number of connections to 21.

67. Through the RANET Programme, the following equipment has been provided to rural communities: i) over 3,050 solar/windup radio receivers; ii) 43 Tongshi DAMB-R satellite receivers; iii) 20 mobile phones as part of a pilot project to test feedback mechanisms; and iv) chatty beetle systems at ZMD HQ and district offices through a pilot project – this is a satellite-based communication instrument able to transmit 159 characters at a time through earth orbiting communication satellites.

68. In addition to these related, on-going initiatives, the LDCF project will link and coordinate with activities under the: i) African Center of Meteorological Application Development (ACMAD) – namely Southern Africa Regional Climate Outlook Forum (SARCOF); ii) Group on Earth Observations' (GEO) AfriGEOSS initiative – and in particular African Monitoring of the Environment for Sustainable Development (AMESD) and Monitoring of Environment and Security in Africa (MESA); and iii) WMO's Global Framework Climate Services (GFCS) initiative.

### *2.3.2 National and local benefits*

69. Zambia is highly dependent on weather and climate-sensitive sectors for food, energy, water,income and livelihoods. These sectors, in turn, are reliant on climate information to inform long-term development plans. Monitoring of the predicted increases in temperature and rainfall vulnerability is therefore necessary to inform planning for adaptation actions for the impacts of climate change in Zambia. The procurement and installation of monitoring infrastructure will provide real-time climate data from most districts in Zambia. Training will be provided to engineers, technicians, climatologists, analysts and weather forecasters, primarily from ZMD, MAL, DWA/WRMA and DMMU. This climate information infrastructure and training, together with the appropriate hard- and software at centralized and decentralized offices, will improve: i) the accuracy and spatial coverage of available climate information; and ii) the use of this information in providing tailored, sector-specific information to sectors and societies vulnerable to the impacts of climate change at a national level. Additionally, strengthening the current institutional framework of the DMMU to ensure collaboration with technical departments of line ministries will result in a streamlined approach to the development of tailored information and the issuing of climate-related early warnings. At present: i) the spatial coverage of automatic stations is not sufficient to provide the required data to inform forecasts on the 1-7 day timescale, and the provision of data from the manual stations is unreliable; ii) there is a lack of skilled personnel to process the available, or any improved, climate data; and iii) there is limited coordination of climate and early-warning related activities in

Zambia. The infrastructure, training and institutional coordination provided through the LDCF project will therefore be of great benefit at a national scale.

70. Other national benefits of the improved access to climate information provided through the LDCF project include increased food security and nutritional status – thereby positively affecting MDG 1 – and better integration of climate change understanding into the health sector – thereby positively affecting MDGs 4 and 6. Furthermore, the improved availability of climate information will improve environmental planning, infrastructural development, and farming practices – thereby positively affecting MDG 7. Capacity will also be strengthened to integrate climate change risk reduction strategies into development policies and programmes. Overall, the project will contribute to building adaptive capacity to climate change in all sectors in Zambia.

71. At a local level, the project will focus its interventions on establishing community-based EWSs in Chipata (Eastern Province), Sesheke (Western Province) and Gwembe (Southern Province) Districts (Figure 1). These districts were selected, through the DMMU/World Food Programme (WFP) Gender Based Participatory Risk Analysis Pilot Project[19], because of their:

- high vulnerability to floods and droughts (based on a secondary review of the Zambia Vulnerability Assessment Committee (ZVAC) assessments reports for 2005, 2007, 2008, 2009 and 2010);
- high level of chronic food insecurity (based on ZVAC and Living Conditions Monitoring Survey (LCMS) assessment reports);
- high level of extreme poverty incidences; and
- geographical location based in the priority Zambezi and Luangwa Valley areas.

72. Two-way, mobile phone-based EWSs will be established in each of the above districts, which will allow communication of flood, drought, health and other climate-related early warnings to vulnerable communities. This provision of timely information will benefit communities in the three districts through: i) avoided loss of life and infrastructure from severe climate hazards such as floods and storms; ii) increased access to agricultural information and awareness of drought forecasts to improve agricultural productivity and enhance food security; iii) improved health status of people and animals; iv) improved access to market information with associated improvements in financial security; and v) improved access to educational material and training opportunities whilst the EWS is established. The two-way system will allow communities to send relevant, climate hazard-related information back to line ministries via the existing framework within the DMMU, which will be strengthened through the LDCF project.

73. Women and men play different roles in society and have different access to information in disaster-related situations. In Zambia, traditional gender roles mean that women make up the majority of smallholder farmers and are generally responsible for water collection and family health. Zambia's Gender Policy (2000) highlights the specific vulnerabilities of women, including limited livelihood options, restricted access to education and information services, and insufficient means to recover assets after disaster events. As such, women will benefit directly from improvements in the provision of flood, drought, health and other-climate related information and warnings.

74. The priority districts where the EWS will be implemented – Chipata, Gwembe and Sesheke – were selected through gender-sensitive surveys. Similarly, to ensure an effective early warning system is developed that includes all vulnerable persons in a community, specific project demonstration sites within these districts will be selected based on gender-sensitive assessments. The results of these assessments will be used to develop an early warning system dissemination toolbox, which will include a trainer manual on the use of a range of national and local gender-sensitive media for disseminating weather and climate information alerts to end-users. Radio has been shown to be the most dominant and widespread medium for accessing information, however, men are more likely to

[19]DMMU and UN-WFP. 2012. Inception Baseline Assessment Report for the Gender Based Participatory Risk Analysis Pilot Project.

have access to a radio than women[20]. Mobile phones are seen as an effective means of conveying information to women in Zambia, more so than television and internet[21]. One of the objectives of the mobile-based alert platform that will be established through the LDCF project is to ensure that at least 50% of mobile phone users are women**.** It is essential that this goal is reached, as women are often the worst affected by the impacts of climate change, due to their predominantly agriculture-based livelihoods[22]. Women need to be able to access climate information as easily as men – even if it is through differing mediums – otherwise there is the risk of the information either not being used at all or not being fully understood by women. Emphasis will therefore be placed on ensuring that the most appropriate means from engaging women through the EWS are prioritised in the LDCF project. Based on the 2010 population census[23], the LDCF project will benefit 599,751 people at the local level, including: i) 452,428 people (230,738 women) in the Chipata District; 94,612 people (48,252 women) in the Sesheke District; and 52,711 people (26,883 women) in the Gwembe District. This represents approximately 5% of the Zambian population, and approximately 2.6% of women in Zambia.

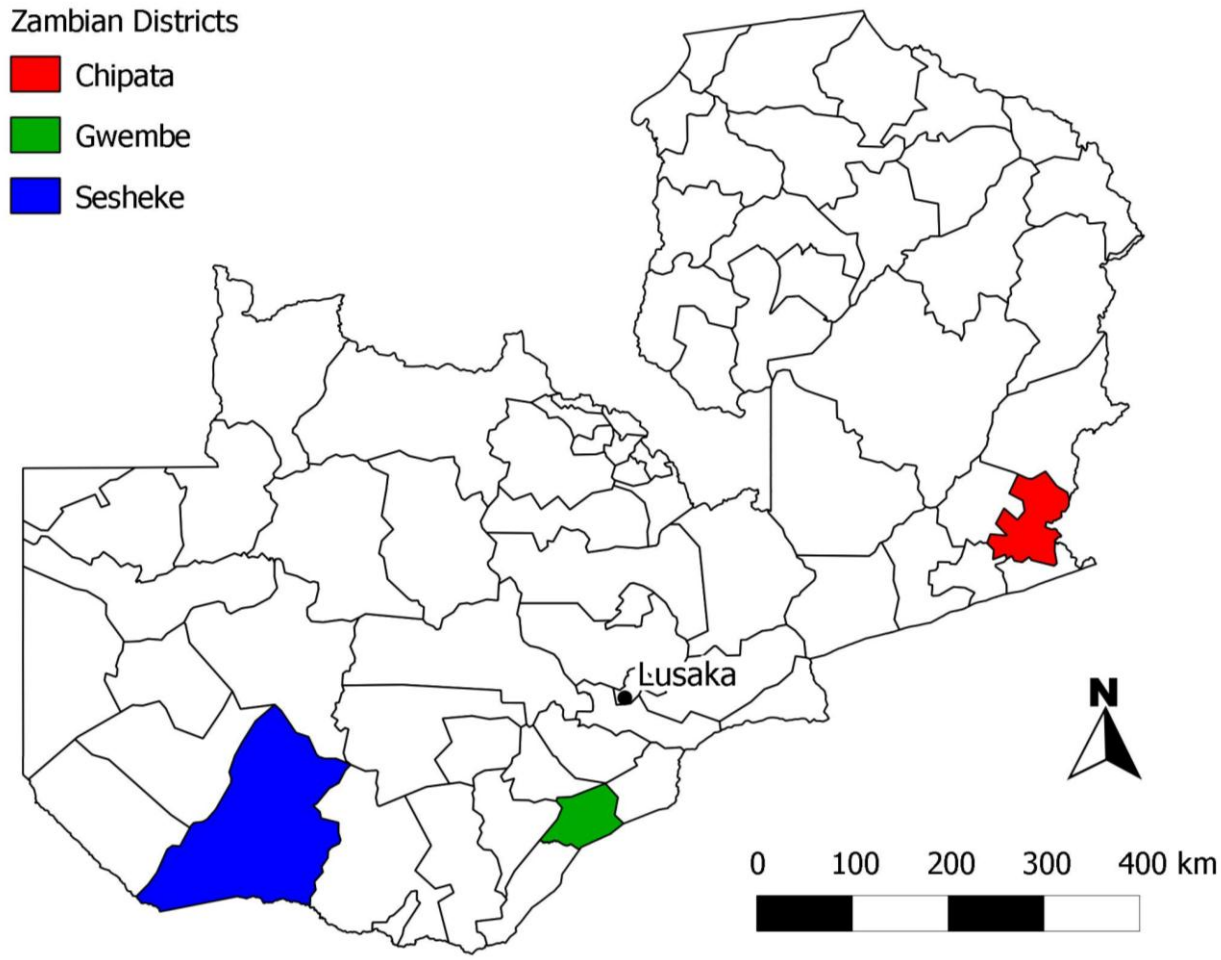


**Figure 1:** LDCF project target districts for the cross-sectoral community-based EWS.

[20] AudienceScaes Development Research Briefs. 2010. Zambia: Barriers to Traditional Media Use and Access. InterMedia Survey Institute.
[21] AudienceScaes Development Research Briefs. 2010. Case Study: Young Zambia Women's Access to Information about Maternal and Child Health. InterMedia Survey Institute.
[22]Tall, A. and Chouwdhury, M. 2012. Who gets the information? Gender, Power and Equity considerations in Climate Services Provision - Lessons from Climate Service Provision toWomen Farmers in Kaffrine (Senegal), 2011-12. Working Paper. CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS): 1-60.
[23]Central Statistical Office. 2011. 2010CensusofPopulationandHousing: Preliminary Population Figures.

### *2.3.3 UNDP comparative advantage*

75. The proposed project is aligned with UNDP's comparative advantage in the areas of capacity building, and providing technical and policy support for EWS/DRR related initiatives. Additionally, UNDP has close links with the GRZ and has accumulated considerable experience in managing GEF, LDCF and other projects in the country and region, including [24, 25]:

- Seven national projects funded through the GEF, excluding the LDCF climate information and EWS project, with a combined financing total of US$ 23,435,840 (co-financing of US$ 87,913,000). Of these seven projects, three focus on Climate Change and multi-focal area capacity building (US$ 3,847,500; co-financing of US$ 7,098,000) and therefore demonstrate UNDP's comparative advantage in delivering LDCF project support.
- As of 2011, the UNDP country office was in the process of implementing 42 projects with a combined expenditure of US$ 56,477,407. Of these, six are related to climate change and climate information, with a combined expenditure of US$ 1,332,762.
- UNDP is supporting the LDCF-funded project "Adaptation to the effects of drought and climate change in Agro-ecological Regions I and II", which includes developing effective EWS for 8 priority districts and the installation of agro-meteorological monitoring stations and associated communication channels. This experience is directly related to the implementation of the climate information and EWS project.

76. As part of the UNDAF, and within the context of delivering as "One UN", the UN in Zambia has developed a Joint Programme in cooperation with the GRZ,with the objective of developing capacity and increasing investments at national and local levels for an effective multi-sectoral and multi-level response to climate change. UNDP is providing US$ 16,150,056 of the total US$ 20,150,500 of funding for the project. The Joint Programme brings together seven agencies – FAO, UN-HABITAT, UNDP, UNICEF, UNIDO, WFP and the Global Mechanism of theUNCCD. Main Government partners for this programme will include the following ministries: i) Finance and National Planning; ii) Land, Natural Resources and Environmental Protection;iii) Local Governmentand Housing; iv) MAL;v) Mines, Energy and Water Development; vi) MTWSC (ZMD); vii) Commerce, Trade and Industry; viii) Justice; ix) Chiefs and Traditional Affairs; x) the Gender and Child Development Division; and xi) the Office of the Vice President (DMMU). Others partners are: i) local communities in selected sites;ii) Civil Society Organisationssuch as the Zambia Climate Change Network (ZCCN); iii) international organisations such as CIFOR; and iv) the private sector in the form of Lloyds Financials and the African Carbon Credit Exchange. Engagement and co-ordination of these key role players, including ZMD and DMMU,clearly demonstrates UNDP's comparative advantage in working and coordinating across government institutions in Zambia.

77. UNDP is currently working on climate information and EWSs in many countries and sectors(including agriculture andflood management) across the globe, including Asia (Nepal, Lao and Cambodia) and the Pacific (Solomon Islands, Fiji and Samoa). This global experience is brought to bear in a flexible and locally sensitive manner in each country, thereby maximising the application of global technologies and experience whilst accomodating local circumstances.The Zambia country office is supported by Regional Technical Advisors at UNDP offices in Addis Ababa, as well as by policy, adaptation, economics and climate information and modelling experts in New York, Cape Town and Bangkok.

## 2.4. Project Objective, Outcomes and Outputs/activities

[24]For further information see: http://www.thegef.org/gef/gef_projects_funding [Accessed 27 March 2013].
[25]For further information see: http://africaopendata.org/sl/dataset/undp-projects-2011-zambia [Accessed 27 March 2013].

78. The **objective** of the LDCF project is "to strengthen the climate monitoring capabilities, early warning systems and available information for responding to climate shocks and planning adaptation to climate change in Zambia."

79. This will be achieved by delivering two integrated and complementary outcomes:
1. Enhanced capacity of Zambia Meteorological Department to monitor and forecast extreme weather and climate change.
2. Efficient and effective use of hydro-meteorological and environmental information for making early warnings and long-term development plans.

80. The overall budget for the LDCF project is US$ 3,600,000 over four years (Table 2).

**Table 2:** LDCF budget per outcome.

| **LDCF outcome** | **LDCF Funding (US$)** | **Indicative Co-financing (US$)** |
|---|---|---|
| 1. Enhanced capacity of Zambia Meteorological Department to monitor and forecast extreme weather and climate change. | 2,284,000 | 10,075,720 |
| 2. Efficient and effective use of hydro-meteorological and environmental information for making early warnings and long-term development plans. | 1,136,000 | 3,056,227 |
| Project Management | 180,000 | 400,000 |
| **Total** | **3,600,000** | **13,531,947** |

81. The objective and outcomes of the LDCF project are aligned with UNDP's thematic focus on adaptation to climate change. These are furthermore specifically aligned with outcomes linked to LDCF Climate Change Adaptation (CCA) Focal Area (FA) objectives 2 and 3 (see Annex 3, UNDP/GEF M&E Framework for Adaptation).

82. The **baseline situation** (*without the LDCF project*) – including associated baseline projects and co-financing – and **adaptation alternative** (*with the LDCF project*) – including relative outputs and indicative activities – are detailed below for each component and associated outcome.

**Component 1: Transfer of technologies for climate and environmental monitoring infrastructure.**

**Outcome 1: Enhanced capacity of Zambia Meteorological Department to monitor and forecast extreme weather and climate change**.

83. Outcome 1 will be achieved by installing a sustainable network of automatic weather stations under ZMD.This network will be established using a phased approach, ensuring each phase of installed equipment is fully operational before the next phase of equipment is installed. High risk districts, in terms of vulnerability to floods and droughts, will be prioritised for installation of automatic weather stations. Modern forecaster facilities (including workstations)will be installed to assist the meteorological team at ZMD in processing and analysing data, as well as integrating and using raw data for weather and climate forecasting purposes.

84. New infrastructure, including weather stations and forecasting facilities, will build upon and be integrated into the existing ZMD and partner institution infrastructure and capacity. Partner institutions in the generation and processing of weather, climate and hydrological data include DWA/WRMA (hydrological stations are being installed through associated baseline projects to provide the required hydrological data and processing infrastructure/expertise to be able to forecast flooding), while the University of Zambia (UNZA) Physics and Mathematics Department as well as the School of Natural Sciences are involved in climate-related research and modelling. Collaboration between ZMD, DWA/WRMA, UNZA will be strengthened to ensure optimal use of weather and climate data, under the custody of ZMD. LDCF project activities under this outcome will also

complement existing meteorological and hydrological support programs being implemented by GRZ/UN and WB (see further details below and co-financing amounts in **Error! Reference source not found.**). This will provide a solid platform for the effective and efficient use of hydro-meteorological information for early warning systems and enabling long-term development plans.

85. Outputs under this outcome are specifically aligned with outcomes linked to CCA-FA Objective 2, including 2.1) increased knowledge and understanding of climate variability and change-induced risks at country level and in targeted vulnerable areas; and 2.2) strengthened adaptive capacity to reduce risks to climate-induced economic losses (see Annex 3, UNDP/GEF M&E Framework for Adaptation). The overall budget for this outcome under the LDCF project is US$ 12,349,720. This includes US$ 2,274,000 LDCF project grant requested and US$ 10,075,720 indicative co-financing (**Error! Reference source not found.**).

**Table 3:** Total project value for Outcome 1.

| **Funding source** | **US$** |
|---|---|
| **Co-financing sources** | |
| Southern Africa Science Service Centre for Climate Change and Adaptive Land Management (SASSCAL) project – *Expand, modernize and improve weather observation network; improve forecasting in Zambia*. | 785,000 |
| World Bank (WB) – Water Resources Development Project | 8,000,000 |
| GRZ, Zambia Meteorological Department (ZMD) budget allocation | 1,290,720 |
| **LDCF project grant requested** | 2,274,000 |
| **Total** | **12,349,720** |

*Baseline situation (without LDCF project)*

86. The ZMD is the primary provider of meteorological services in Zambia and the principal institution for gathering weather and climate information and making forecasts. ZMD is responsible for storing weather and climate data and information, as well as communicating this data and information to local communities and various government ministries and departments.ZMD's mandate includes the following: i) establish and maintain a network of surface and upper air stations for the purpose of observing the weather and regional meteorology; ii) process and analyse meteorological data for use in the planning of economic development and for rational exploitation of natural resources; iii) provide meteorological information services to government departments, public corporations and the general public; iv) provide meteorological services for the development of agriculture, water resources and other weather sensitive economic sectors; and v) conduct research in meteorology and to co-operate with organisations concerned with meteorological research and applications. ZMD's annual budget including operation and maintenance is ~US$322,680 per annum.

87. The weather and climate observation network under ZMD includes 39 manual weather stations and 2 AWSs. The stations are situated in less than 40 districts, leaving more than 60% of the districts in Zambia without any observational equipment. Thirty of the manual stations are synoptic, while nine are agro-meteorological stations, with the majority of stations designed to serve the aviation sector. Stations are mostly located on plateaus, rather than in climate-sensitive valley areas. Stations are supposed to be manned by up to 5 observers, who should observe hourly for between 9 and 24 hours a day. However, most stations are manned for less than 12 hours a day by 1 or at times 2 observers. Data from the stations are supposed to be transmitted to ZMD HQ and to the ZMD office at the Lusaka International Airport every 3-6 hours via phone or HF radio with13 out of the 30 synoptic stations meant to transmit their data in real time into the Global Telecommunication System (GTS) of the World Meteorological Organisation(WMO).However, observations are often submitted weekly or even monthly at a time, and often by post. As a result, observations are largely not used to make forecasts, and meteorological data from Zambia are not available for use within international weather forecasting models.

88. The 41 observation stations are supplemented by a voluntary rainfall station network consisting of ~200 rain gauges located at agricultural research centres, education institutions, commercial farms and religious mission centres. Supply of data from these stations to ZMD is sporadic. As of 2010, ZMD has not carried out upper air ascents, has no weather radars or lightning detection system, and has non-functioning GTS communication facilities with other countries/institutions. The current weather and climate observation network of Zambia is shown in Figure 3.

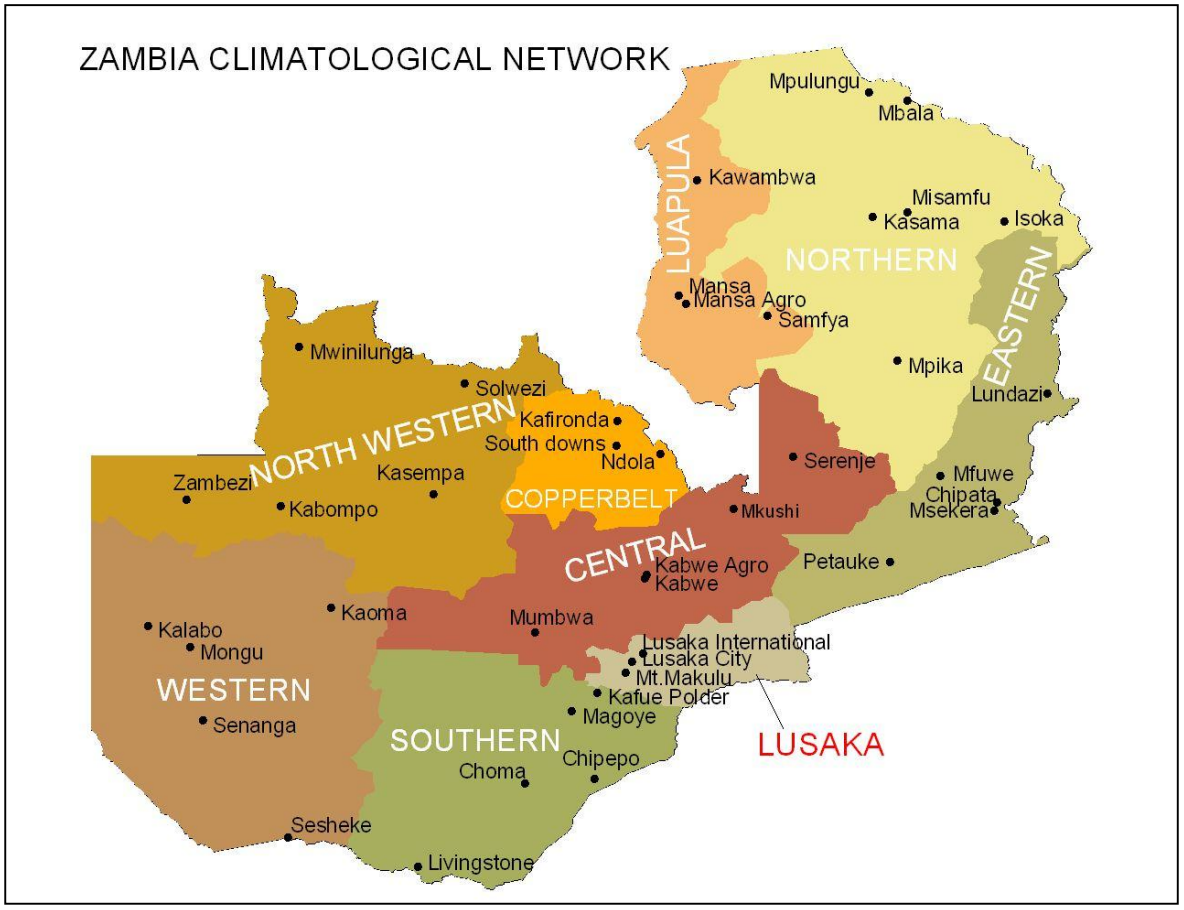


**Figure 3:** Towns where meteorological station network infrastructure is located across Zambia (excluding those installed in 2012).

89. ZMD produces short-term (daily and 7-day) weather forecasts, while longer-term seasonal forecasts are produced by ZMD as part of the SARCOF(Southern African Climate Outlook Forum) process. Daily weather forecasts are produced through the following steps:

- previous days forecasts are reviewed;
- current weather reports (from the ZMD observation network of 41 stations) are checked for consistency when available;
- Regional Meteorological Centre fields (both current and forecast) are reviewed (from South African Weather Service, European Centre for Medium-Range Weather Forecasts, Meteo France, UK Meteorology Office, Canada and National Centres for Environmental Prediction);
- regional satellite imagery is compared with forecasts and available observations;
- a subjective inference is made, based on expert opinion; and
- a consensus forecast is produced which is issued via e-mail (to a subscriber list) and to the Zambia National Broadcasting Corporation and to the Zambia News and Information System.

90. Seasonal forecasts are produced through the SARCOF process, wherebya SADC regional consensus forecast is produced. ZMD contributes to this process by issuing a downscaled national seasonal forecast based on a statistical analysis of historical climate observations and sea surface

temperatures. This national forecast, which provides some indication of the quality (timing and nature) of the rains, is issued to various user sectors who utilize these forecasts for planning their operations e.g. water resource managers at ZESCO.The seasonal forecasts are prepared and disseminated between mid-September and mid-October.

91. There are 8 products and services being offered by ZMD. These are:

- Daily weather forecasts prepared for e-mail and radio dissemination;
- seasonal rainfall forecasts issued in September/October;
- TV weather reports and forecasts issued 3 times a week on Mondays, Wednesdays and Fridays;
- 10-day Crop Weather Bulletin issued every 10 days during the rainy season;
- aviation forecasts issued at all scheduled flight airports and aerodromes in the country;
- severe weather warnings issued when an event is anticipated;
- technical reports/publications issued periodically; and
- climate data supplied on request to all respective stakeholders.

92. Daily and weekly forecasts are issued to those on an e-mail list[26], as well as via radio. Meteorological hazard warnings on tropical cyclones, strong winds, thunderstorms, intense cold, floods and drought to alert the public and relevant government agencies to undertake appropriate interventions are disseminated using national radio broadcasts, telephones, email, print and electronic media. Warnings are also sent to national departments and DMMU. The spatial coverage of the observation network, however, is insufficient to accurately forecast these hazard warningsfor all parts of Zambia, and the fragmented dissemination system means information and warnings are delayed in dissemination, often not being received by users.

93. Zambia has benefited from the PUMA (also known as the Meteorological Transition in Africa Project) and AMESD projects. Under the PUMA project, 3 satellite data receiving stations (GEONETCast stations) were installed at ZMD, MAL and Ministry of Lands, Natural Resourcesand Environmental Protection (MLNREP). The projects also assisted with technical and thematic training programmes. ZMD and MAL now have direct access to all of the products disseminated through GEONETCast. However, due to a lack of capacity to operate the systems effectively,these products are currently not used directly for weather, seasonal or crop forecasting, although the hardware and software allows for such forecasts to be generated.

94. UNZA is participating in the Coordinated Regional Climate Downscaling Experiment (CORDEX) Project – focusing on long-term climate modelling (10-50 years) to inform climate change adaptation planning. This is an initiative of the World Climate Research Programme, and involves the downscaling of 10 Regional Climate Models (RCMs) to produce downscaled climate change scenarios for Zambia. This expertise is valuable, though further collaboration is required with ZMD for the ouputs of the project to be fully utilized for evidence-based adaptation planning.

95. The significant shortage of weather and climate information and monitoring stations in Zambia negatively affects the country's ability to monitor, detect and predict climate variability and climate change. A combination of non-operational, poorly functioning and obsolete infrastructure, as well as poor spatial station coverage, is currently compromisingthe ability of the ZMD to provide detailed and accurate weather and climate information and products (including <1 day nowcasts and 1-10 day weather, seasonal and climate forecasts) to support social and economic development. Obsolete and inadequate equipment – including limited computers, forecasting facilities and communications to access modern weather forecasting technology – limits the integration, display and analysis of weather and climate data and its use. The shortage of automated monitoring stationsand inadequate quality control procedures reducesthe quantity and timeliness of weather and climate information products available for making early warnings and informing long-term development plans.

[26] In-country consultations suggest that the issuance of forecasts is not regular.

96. Other difficulties faced by ZMD above include: i) unreliable provision of data from the existing network – manual stations are supposed to send data at set synoptic hours i.e. (GMT) 06h00, 09h00, 12h00, 15h00, 18h00 and 00h00, however, this data is not always provided, particularly from the stations manned by 1 person; ii) staff shortages – the GRZ is increasing the budget allocated to ZMD which will allow additional staff to be recruited, but the extent of the increase is uncertain; iii) lack of relevant skills related to the latest technologies in meteorology – particularly in support staff and in new staff recruited by ZMD; and iv) lack of access to weather and climate model-related computing equipment.

97. These challenges are being addressed to some extent by the various baseline projects and related initiatives. AWSs are being provided by the: i) SASSCAL project (10 AWSs); ii) Common Market of Eastern and Southern Africa (COMESA – 5 AWSs); and iii) LDCF agriculture project, being implemented by MAL (8 AWSs). This will improve the spatial coverage of the ZMD observation network, but further additional stations are still required. Regarding receiving information from stations, ZMD – with support from the WMO – recently procured and installed an Automatic Meteorological Message Switching System (AMMSS) at the ZMD HQ in Lusaka. This will facilitate data collection, processing and exchange with AWS and also data transmission via the GTS. The system will use the GSM/GPRS system to link AWSs with the ZMD HQ. ZMD currently uses a climate data management system (CLICOM) and has access to numerical weather prediction output from the WRF model through thesevere weather demonstration project (SWDP) supported by WMO.

98. A number of additional development partners and projects in Zambia are investing in hydrological and meteorological infrastructure and training to support the ZMD and DWA/WRMA in addressing their current capacity gaps. As a result of the GIZ and WB projects described in Section 2.3, and based on consultations with the respective project managers and the DWA during the development of this LDCF project, it was decided that LDCF resources would not be used for the procurement and installation of hydrological equipment. This is because the required hydrological equipment and associated capacity building in the hydrological sector is being provided through the GIZ and WB projects. However, the LDCF project will work closely with these related and baseline projects, respectively, and ensure that data generated by the new and rehabilitated equipment is incorporated into the ZMD database and usedfor the generation of early warnings through Outcome 2 of the LDCF project. The existing institutional structures outlining collaboration between ZMD and DWA/WRMA, in particular concerning to data sharing and use, and also with the other line ministries and end-users of the data (DMMU, MAL, CSO, MoH, private sector and vulnerable communities), will be strengthened. This will be achieved through a statutory framework based on the mandates of the various government ministries, and will focus on data collection and analysis (meteorological and hydrological), management and operations of automatic and manual stations (meteorological and hydrological), data exchange, data processing, and assessment and warnings.

*Adaptation alternative (with LDCF project)*

99. The four outputs under Outcome 1 will build on the existing investments being made in the sector by the GRZ, including projects supported by WB and the German Federal Ministry of Education and Research, as described in Section 2.3. Furhermore, the LDCF projects will synergise with activities of the GIZ/KfW investment project in the hydrological and meteorological sectors.

- LDCF resources will be used to improve ZMD's existing meteorological observation network to support effective weather monitoring and climate change adaptation planning. This will include installing AWSs in priority districts,as well as rehabilitating existing manual and automatic stations (Output 1.1). Capacity development will be undertaken to sustain the enhanced observation network during and beyond the implementation phase of the LDCF project (Output 1.3). The main aim of the outcome will be to adequately cover the spatial variability that exists in the current station network to ensure that weather and climate information and data is collected for areas vulnerable to climate change. This will enhance ZMD's capacity to undertake accurate and region-specific weather and climate modeling (Outputs 1.2 and 1.4),as well as provide a

platform for generating early warnings for floods anddroughts, and health warnings related to the spread of climate-influenced disease and epidemics. The required human technical capacity to make improved climate forecasts will be enhancedwithin the ZMD HQ (Lusaka), and at the provincial and district levels.

- The LDCF project will build on and complement the achievements and activities of SASSCAL – the locations of where the AWSs will be installed through the SASSCAL project have not yet been finalised. This decision will be made in conjunction with the LDCF project management and technical teams (through Output 1.1), so that maximum coverage of AWSs is obtained in Zambia. The climate information from the SASSCAL project AWSs will be compatible with the data transfer system and database at ZMD, upgraded to CLIMSOFT through the LDCF project (Output 1.2).
- The LDCF project focus on the weather and climate sector will complement the WB focus on the hydrological sector, at a national level. The approach to the water resources information management system will be established at the Inception Workshop of the LDCF project, in collaboration with both WB and GIZ/KfW.

100. The activities of the LDCF project will be implemeted in allignment with the GIZ/KfW investments in both the hydrological and meteorological sectors, particularly investments in 200 rainfall gauges for volunteer stations in the Kafue Sub-basin, the installation of IT infrastructure, and procurement of vehicles for ZMD and WRMA. The rainfall data will be integrated in the upraded (through the LDCF project) CLIMSOFT database (Output 1.2) used by ZMD, and ZMD will generate climate data through the provision of LDCF-financed AWSs, that will be made available to DWA/WRMA to improve the accuracy of hyrdological modeling. This exchange of information will be directed by the framework established through Outcome 2.

**Output 1.1** 28 Automatic Weather Stations procured and installed, and 41 existing manual and automatic monitoring stations rehabilitated.

101. Under Output 1.1, the geographical coverage of Zambia's weather and climate observation network will be extended through the installation of 28 AWSs in priority districts to adequately cover agro-meteorological, climatological, hydro-meteorological, synoptic and isohyet (rainfall variability) zones in the country. The 28 priority districts are shown in Table 4 and Figure 4 below. The installations will complement the AWSs installed in: i) 5 districts using funding from Common Market of Eastern and Southern Africa (COMESA); ii) 8 districts through the LDCF agriculture project being implemented by MAL; and iii) 10 districts through the SASSCAL project – districts are yet to be finalized.

**Table 4:** Priority districts where AWSs will be installed through the LDCF project.

| **Priority Districts** | | | |
|---|---|---|---|
| Chavuma | Kalabo | Magoye | Mwinilunga |
| Chipata | Kalomo | Mansa Agricultural station | Nakonde |
| Chipepo | Kalulushi | Misamfu Agricultural station | Samfya- Marine |
| Chisali | KapiriMposhi | Mkushi | Senanga |
| Kabwe Agricultural Station | Kasempa | Mpika | Serenje |
| Kafue Polder | Kawambwa | Mpongwe | Sesheke |
| Kafulafuta | Lufwanyama | Mumbwa | Zambezi |

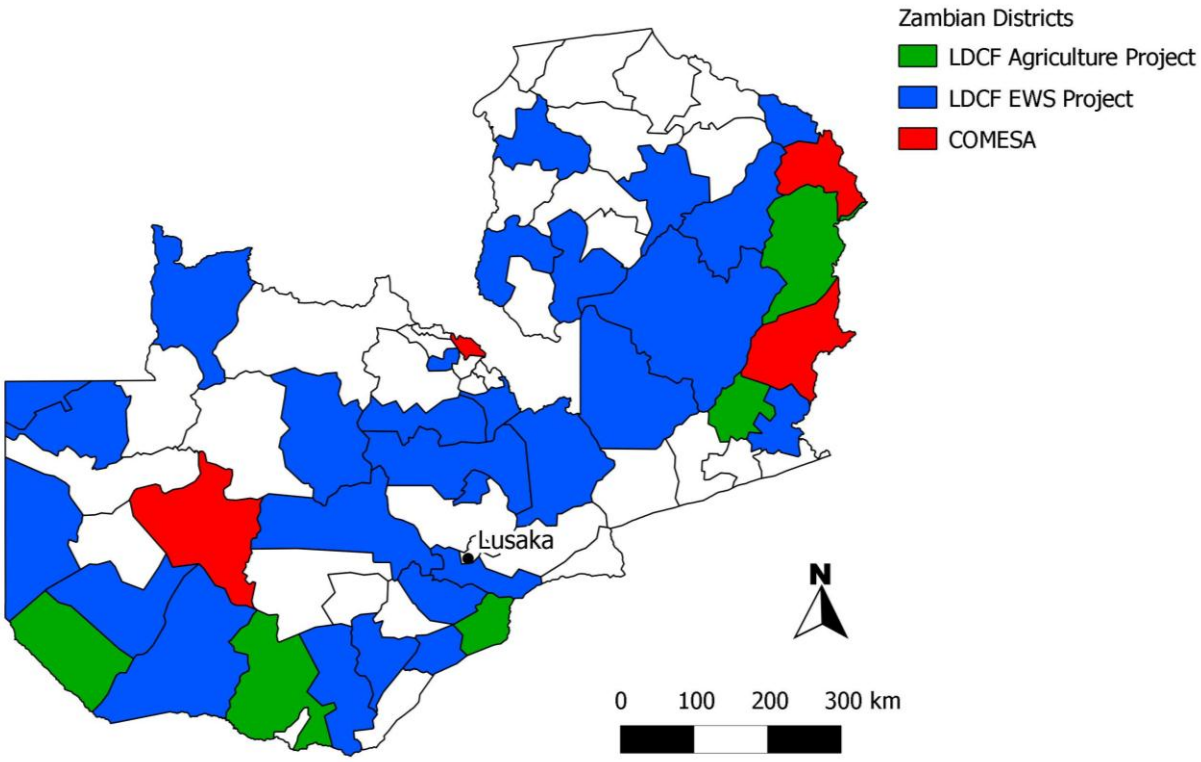


**Figure 4:** Priority districts where AWSs will be installed through the LDCF project (blue). Also shown are those districts where AWSs will be installed through the COMESA project (red) and have been installed through the LDCF agriculture project (green). The districts where the 10 AWSs are to be installed through the SASSCAL project are not shown.

102. A systematic gap analysis will be undertaken to map the: i) required spatial distribution of stations; ii) required climate parameters; and iii) required number of observation hours per station. The mapping will lead to an informed decision on exactly where within the priority districts to install new weather stations, how frequently these need to transmit data, and how to integrate them in the existing network. The AWSs will conform to and be compatible with the already installed AWS network to ensure ease of integration, installation and operation.

103. LDCF resources will also be used to rehabilitate obsolete and poorly functioning stations. This will necessitate an updated mapping/catalogue of the required rehabilitation and upgrading works, specifying what is required at each station. A list of all required spares, accessories and equipment to be procured to undertake the recommended rehabilitation and upgrading will be compiled. At manual stations,this will includethermometers, barometers, Stevenson screens, wind speed and direction masts, solar and wind sensors, and radiotelephones for communication. At automatic stations, this will include sensors, data loggers, GPRS modems, Solar Power Systems, computer servers and software, and wind speed and direction masts. In addition to this, weather fencing, power supply, solar panels and batteries will be financed to protect and ensure the adequate functioning of the stations installed and/or rehabilitated. Manual observations will be continued at sites where it is not cost-effective to automate, for example at sites in remote locations and lacking communication facilities. Where manual stations are replaced with automatic stations, there will be an overlap of 36 months to allow for adequate comparisons between changes in sensors/sites.

104. The AWSs will be installed in a systematic and phased approach, as opposed to all 28 being installed concurrently. This will allow for lessons learned from the initial installations to be applied to those installed in subsequent phases, as well as making it easier to adapt technologies and processes early on, i.e. to ensure the system is stable and functioning before scaling up operations.

Output 1.1 includes the following **activities:**

**1.1.1** Undertake a systematic analysis of existing synoptic, climatic, rainfall and agro-meteorological stations to determine gaps in coverage and priority stations for rehabilitation. This will include an identification of the location where the AWSs will be installed within the priority districts (shown in Table 4 and Figure 4).

**1.1.2** Procure and install 28 AWSs in the priority districts including solar panels, batteries and GPRS modems for data transmission.

**1.1.3** Rehabilitate/upgrade 41 existing meteorological stations (including 2 automated weather stations and 39 manual stations) including procuring and replacing relevant sensors, and data loggers for automated stations and instruments for manual stations, as required.

**1.1.4** Integrate new AWSs into the existing ZMD network and forecasting system, including reviewing and installing appropriate telecommunication infrastructure.

**Output 1.2** Weather and climate forecasting systems updated, including the installation of required hardware and software and integration of satellite observations.

105. LDCF resources will be used to procure and install the hardware and software needed to integrate, display, analyze and provide output of observed and model data as well as other graphical information. ZMD will upgrade its severe weather demonstration project (SWDP) numerical weather prediction model (the WRF). Integration with products from the 3 AMESD satellite receivers (at ZMD, MAL and Zambian Environmental Management Agency [ZEMA]) will be achieved through installing the appropriate hardware and software to allow for improved climate forecasting. Collaboration with ZEMA and MAL teams will be established to ensure the most appropriate interface.

106. This output will include an upgrade of the national database and information management system. This will involve: i) review and assessment of gaps in the existing climate data management system (CLICOM); ii) the transition from CLICOM to improved climatic software (CLIMSOFT); iii) an assessment of how to provide for an integration interface with the recently developed Zam-Clipac product development model; and iv) procurement of an upgraded data management system that is able to integrate data from the installed AWSs into the CLIMSOFT database and Zam-Clipac model.

107. ZMD – with support from the WMO – recently procured and installed an Automatic Meteorological Message Switching ystem (AMMSS) at the ZMD HQ in Lusaka. This will facilitate data collection, processing and exchange with AWS, and also data transmission via the GTS. The system will use the GSM/GPRS system to link AWSs with the ZMD HQ. At present, the majority of stations are connected through Zamtel. Through this output, the remaining and new stations will be conncted (through Zamtel and GSM).

108. Processing thedata from the newly installed and connected AWSs will require the use of sophisticated workstations (hardware and software). These workstations will provide the platform for ZMDs meteorologists to: i) visualize meteorological, environmental and oceanographic data; ii) produce standard and customized <1 day severe weather nowcasts, 1-10 day weather forecasts, 1-6 month seasonal forecasts and >6 month climate forecasts; and iii) edit and package weather and climate data and information into a suitable format for user-agencies and end-users. These workstations will provide the means to generate calibrated weather forecasts based on numerical weather prediction models, graphical imagery, surface observations and station-based forecasts.

109. The Satellite Distribution System (SADIS) will be installed to provide proxy upper air monitoring ascent measurements. This is because installing, operating and maintaining an upper air monitoring station was considered to not be be the most cost-effective use of funds (due to daily

operational costs). The SADIS is provided free of charge to LDCs. Capacity will be built on how to operate the SADIS and how to use these data for weather and climate forecasting.

Output 1.2 includes the following **activities**:

**1.2.1** Improve ZMD's access to international forecasts and numerical weather prediction modelling capabilities and integrate the data from the AMESD satellite receivers. This will include strengthening collaboration between ZMD, MAL and MTENR.

**1.2.2** Upgrade and update the national ZMD database from CLICOM to CLIMSOFT.

**1.2.3** Review and install appropriate telecommunication infrastructure to establish connectivity of the installed AWSs with ZMD HQ, as well as via the GTS.

**1.2.4** Procure and install equipment including the hardware and software required for modern meteorological forecasting workstations at ZMD HQ.

**1.2.5** Develop and establish an online data platform linked to ZMD's official website. This will allow DMMU, DWA/WRMA, MAL, CSO, MoH and other end-users to access specific meteorological data, under the custody of ZMD and as outlined in the framework developed in Output 2.1.

**1.2.6** Conduct training on the Satellite Distribution System (SADIS 2G) and install receivers and a dedicated workstation to provide proxy upper air monitoring ascent measurements.

**Output 1.3** Capacity developed for operating and maintaining the climate observation network and related infrastructure including the training of 10 engineers, 10 technicians and local communities to maintain and repair meteorological equipment, computer infrastructure and telecommunications network.

110. UnderOutput 1.3, LDCF resources will be used to develop the human technical capacity as well as the internal arrangements, procedures and frameworks required to maintain and operate the improved meteorological observation network in Zambia. Capacity development support and provision of technical assistance will support the current ZMDinstruments division in the use of technologies in compliance with WMO standards.The capacity of personnel responsible for running/maintaining equipment and receiving/archiving data (including manually operated stations, where necessary) will be built, as will that of computer technicians who will maintain the computer infrastructure and telecommunications systems, both existing and provided through the LDCF project. The capacity development will stress the importance of using cost-effective technologies which are able to interface with existing systems and which minimize dependence on external suppliers of hardware and software.

111. A 'train the trainers'approach will be used to maximize the effectiveness of LDCF funds. Specific advanced technical training will be provided to the 20 personnelto cover the operation and maintenance of AWSs, as well as of the computer equipment (workstations), including hardware and software. Agreements will be established with individuals trained to develop and conduct training courses for technicians working in ZMD. The agreements will ensure those trained remain in the relevant government departments for the minimum period after receiving the training. Training will also be provided on routine servicing and maintenance of infrastructure, e.g. greasing anemometers and wind vanes, dusting equipment, and unblocking rain gauges. The sustainability of LCDF project interventions will be strengthened through an awareness campaign undertaken by trained trainers to explain to the communities the benefits of the installed equipment and the need to prevent the equipment from being vandalized.

Output 1.3 includes the following **activities**:

**1.3.1** Develop a climate observation quality control and maintenance toolbox, including remotely accessible and online calibration and training courses, handbooks and manuals for AWSs and manual stations.

**1.3.2** Train 10 engineers (1 per province, to diploma level) to maintain and repair newly installed and rehabilitated meteorological equipment.

**1.3.3** Train10 engineers (1 per province, to diploma level) to maintain and repair newly installed and existing computer infrastructure and telecommunications systems.

**1.3.4** Implement an awareness raising campaign, led by the engineers trained through Activities 1.3.2 and 1.3.3, in local communities situated close to installed and rehabilitated stations on the importance/benefits of installed equipment.

**Output 1.4** Technical capacity of ZMD is strengthened to improve the production of standard and customized weather and climate forecasts and packaging meteorological data and information into a suitable format for user agencies and local community end-users.

112. The capacity of ZMD staff in the Lusaka HQ, as well as at provincial offices and at district monitoring stations, will be enhanced to make region-specific weather and climate forecasts to facilitate the provision of more relevant meteorological services to users in specific locations and sectors. This will include strengtheninghuman capacity to: i) visualize meteorological, environmental and oceanographic data; ii) contextualizelocally observed data and nationally developed severe weather < 1 day nowcasts, 1-10 day weather forecasts, 1-6 months seasonal forecasts and > 6 month climate forecasts, to be applied at the local level; and iii) edit and package weather and climate data and information into a suitable format for user-agencies – including DMMU, MAL, MoH and CSO – and local community end-users. This will link to the capacity developed within the ZMD through other initiatives such as the Danish Government support thorough the Danish Meteorological Institute.

113. A 'train the trainers'approach will be used through this output. This will include not only training forecasters in state-of-the-art and region-specific weather and climate forecasting, but also in capacity building for other meteorologists at ZMD. This will include capacity building on the range of online tools and courses that are available for improving meteorological and hydrological skills. Agreements will be established with individuals trained to develop and conduct training courses for other meteorologists at the ZMD – particularly employees at synoptic stations – as well as ensure that they remain in the relevant government departments for a minimum period after receiving the training.

Output 1.4 includes the following **activities**:

**1.4.1** Train: i) 4 senior climatologists (based in Lusaka); ii) 20 analysts (2 in each province);iii) 28 weather forecasters (1 per AWS installed); and iv) 3 researchers based at UNZA on state-of-the-art region-specific weather and climate forecasting including the use of observed data, forecasting stations and data storage and information management systems installed under Output 1.2. This will include training on building in-house capacity of other meteorologists at ZMDs, synoptic and agro/hydro-meteorological stations.

**1.4.2** Develop training packages and toolkits for assisting trained meteorologists to build in-house forecasting capacity in ZMD (both at HQ and the provincial level) and to mainstream the online platform and integrated data storage and management systems developed under Output 1.2.

**1.4.3** Develop local products at the provincial level, in partnership with local community organisations, to combine local observations and forecasts to produce relevant community-level weather and climate-related information.

**1.4.4** Support 2 scholarships for post-graduate training in climatology at an international research centre/university. An agreement will be signed with the selected students committing them to an internship at ZMD, equalling the duration of the scholarship.

**Component 2: Climate information integrated into development plans and early warning systems.**

**Outcome 2: Efficient and effective use of hydro-meteorological and environmental information for making early warnings and long-term development plans.**

114. Outcome 2 will be achieved by developinghuman technical capacity to use the data collected from the modernized weather and climate observation and information management systems established under Outcome 1.

115. The capacity of DMMU, DWA/WRMA, MAL, MoH, CSO and INCCS will be developed to work with the ZMD to streamline, consolidate and customise weather and climate services for government, private sector, civil society and development partners. This will be supported through a National Early Warning and Disaster Management Committee (NEWDMC) and an online early warning system platform coordinated and housed at the DMMU. The NEWDMC will include a National Disaster Management Technical Committee (NDMTC, already operational) and a National Early Warning Technical Committee (NEWTC, established though the LDCF project). Through Outcome 2, the various EWSs functioning to some degree in Zambia will be streamlined into a consistent service.The dissemination of information will be channeled through DMMU when the information constitutes a warning, as determined through systems established by the NEWDMC. In addition to warnings, tailored weather and climate forecasts and information for the agriculture, aviation, water, health , tourism, construction, transport and energy sectors will be generated. This will be through collaboration between ZMD and the respective sectors. Dissemination will occur through extension services within the relevant line ministries and collated through the DMMU ZEPRIS system. When the information constitutes a warning, this will be disseminated through the DMMU channels established through Output 2.3.

116. Outcome 2 will support the timely sharing and dissemination of relevant weather and climate data and information with users at both the national and district levels. Standard Operations Procedures (SOPs) for disseminating and responding to weather and climate forecasts through a two-way, mobile phone-based EWS will be established. The EWS will be implemented in Chipata, Gwembe and Sesheke Districts, which were found to be particularly vulnerable to floods and droughts through a gender-based vulnerability assessment. The system will allow communication of primarily flood and drought warnings, but also those related to health and other climate-related early warnings to vulnerable communities. The activities under this outcome will improve the resilience of local communities to climate change by enabling them to plan for, and respond to, climate change impacts.

117. LDCF project activities under this outcome will complement existing disaster risk reduction and community-early warning system activities under the GRZ/UNDP (see further details below and co-financing amounts in Table 5).

118. Outputs under this outcome are specifically aligned with outcomes linked to CCA-FA Objective 2, including 2.1) increased knowledge and understanding of climate variability and change-induced risks at country level and in targeted vulnerable areas; and 2.2) strengthened adaptive capacity to reduce risks to climate-induced economic losses(see Annex 3,UNDP/GEF M&E Framework for Adaptation). The overall budget for this outcome under the LDCF project is

US$4,192,227. This includes US$1,136,000 LDCF project grant requested and US$3,056,227 indicative co-financing (Table 5).

**Table 5.** Total project value for Outcome 2.

| **Funding source** | **US$** |
|---|---|
| **Co-financing sources** | |
| Government of the Republic of Zambia (GRZ) / UN Joint Programme on Climate Change and Disaster Risk Reduction. | 1,000,000 |
| GRZ, Disaster Management and Mitigation Unit (DMMU) budget allocation | 2,056,227 |
| **LDCF project grant requested** | 1,136,000 |
| **Total** | **4,192,227** |

*Baseline situation (without LDCF project)*

119. There are various actors involved in the generation and dissemination of climate-related early warnings. Theseinstitutions (e.g. DMMU, DWA/WRMA, MAL, CSO and MoH)use climate and weather information provided by ZMD to generate warnings. These warnings and collaborations are described below per sector. The approach is currently uncoordinated, resulting in mixed messages reaching sector and community end users at sporadic time intervals. This is because of a lack of streamlining and data standards and warnings protocols, and results in less effective warnings as end-users are uncertain of how to react.

**Agriculture and Food Security**

120. The Agricultural Statistics and Early Warning Section (ASEWS) within MAL has the responsibility of providing early warning information on food security. This includes crop forecasting, between March and April, and post-harvest surveys, between September and October. The key participating institutions providing input into the sector are ZMD, CSO, FEWSNET and DMMU.

121. MAL extension officers at block and camp levels collect the following information: i) status of farm inputs (seeds and fertilizer); ii) date of planting; iii) phenological observation during the rainy season; iv) livestock status; and v) rainfall data from installed rain gauges. This information is filled in on a specific form which is sent to the District Agricultural Coordinator (DACO). The DACO compiles the information which is in turn sent to the Provincial Agricultural Coordinator (PACO), who sends it to the ASEWS at MAL HQ for processing and analysis. ASEWS combines this information with ZMD seasonal rainfall forecasts and Ten-Day Crop Weather Bulletins to generate the monthly Crop and Livestock Bulletin and Food Security Situation Bulletin for the country. This information is disseminated to local communities through the MAL extension officers at block and camp level.

122. The bulletin is sent via e-mail to cooperating partners, NGO's, UN agencies, the private sector and the Zambia National Farmers Union (ZNFU). At the local level, the DACO distributes the information to extension officers at block and camp levels for onward dissemination to the local farmers for planning appropriate agricultural activities during the rainy season.

123. CSO, a department under the Ministry of Finance and National Planning (MFNP), is a contributor to the ASEWS. Through its Agriculture and Environment Statistics Division, CSO conducts three types of survey: i) Crop Forecast Survey (December/January); ii) the Agricultural and Pastoral Production Survey (April/July); and iii) the Post Harvest Survey (September/October). A household listing and crop forecast is issued in March/April. CSO uses the AGROMET SHELL model to forecast crop production. This model uses rainfall data/forecasts issued by ZMD as input. CSO has a website where all statistical information of Zambia can in theory be accessed to stakeholders in the country and beyond. However, the website is generally not accessible and data are outdated.

**Disaster Management and Mitigation Sector**

124. DMMU is the agency mandated with Disaster Risk Reduction and dissemination of disaster-related information and warnings to rural communities. The current focus of activities is reactive, i.e. rehabilitation and reconstruction activities. Data is requested for the purposes of contingency planning and budgeting based on the seasonal predictions of floods and droughts. This is based on overlaying risk maps – supplied by the Vulnerability Assessment Committee (VAC) within the WFP – with national seasonal forecasts supplied by the ZMD. A subjective estimate of cost of disasters over the next rainy/dry season is then made, and a contingency budget set aside.

125. Currently DMMU issues official warnings via mobile phone, the media, megaphones and through flyers. When disasters occur, the Emergency Operation Centre (EOC) is tasked with reacting. The EOC's activities are informed by 1-7 day forecasts issued by ZMD. At present, however, the information is not provided to DMMU with sufficient accuracy or timeliness to provide adequate warnings.To maintains close links with multi-sectoral institutions that provide early warning services, DMMU has established an Expert Group to form a core Early Warning System Sub-Committee to work with the EOC to strengthen preventative/planning activities. An integrated Zambia Emergency Preparedness Response Information System (ZEPRIS) model is being developed to connect EWS providers and end-users. In this regard, protocols between DMMU, ZMD, MAL and CSO need to be strengthened.

**Water and Energy Sector**

126. Energy utility companies such as ZESCO Ltd and Zambezi River Authority (ZRA) use rainfall forecasts as inputs into their hydrological models for electricity generation. These then produce flood forecasts for regions and river basins (such as the Zambezi) close to ZESCO and ZRA operations. However, flood forecasting activities in Zambia are currently weak and need to be strengthened. This will be the focus of the baseline projects described in Outcome 1.

**Health Sector**

127. The MoH has an Early Warning System for Disease and Epidemics with a well-established Health Management Information System (HMIS) maintained at MoH HQ. At the national level, MoH is a member of NDMTC sub-committee on Health, Water Sanitation and Nutrition. It also sits on the National Epidemic Preparedness, Prevention, and Control Management Committee co-chaired by Ministry of Local Government and Housing. MoH has strong collaborations with the Defence Forces, WHO, UNICEF, NGOs (e.g. Red Cross) and Local Authorities. The early warnings inform communities about outbreaks of diseases like malaria and cholera and other water and air-borne diseases. However, climate change is not taken into consideration when warnings are issued, despite the strong link between climate hazards and the spread of diseases such as malaria.

**Environment and Tourism Sector**

128. The role of the CCFU, under the ministry's Department of Environment and Natural Resource Management, is to assist the ministry to coordinate and facilitate the development of comprehensive climate response strategy for Zambia and implement immediate initiatives on climate change. While no warnings are issued by the MTENR, climate hazards are important for tourism purposes. MTENR corresponds with DMMU and other statutory bodies in the environmental sector such as Zambia Wildlife Authority (ZAWA), Environment Council of Zambia (ECZ) and the National Heritage Commission.

**Aviation Sector**

129. The ZMD is the sole authority charged with the responsibility of providing weather and climate information to the aviation industry. The operations of aircraft, including ensuring the safety of passengers, crew and cargo, rely on *inter alia*: i) landing and take-off forecasts; ii) aerodrome forecasts; iii) area and route forecasts; iv) aerodrome and wind shear warnings; and v) flight documentation.This information is directly or indirectly issued to aircraft operators by the meteorological officials located at various aerodromes or through National Airports Corporation and Department of Civil Aviation Air Traffic Services Unit.

130. Despite the numerous warnings issued and used by the sectors described above, and summarized below in Table 6, the approach of producing and disseminated warnings is uncoordinated and based on limited weather and climate observations. This means false or duplicated warnings are sometimes issued, which reduces the confidence of end-users in the information supplied.

**Table 6.** Early warnings currently issued in Zambia.

| Early Warning | Communication |
|---|---|
| Severe weather warnings (ZMD) | National radio, e-mail, telephone and via DMMU |
| Agricultural Statistics and Early Warning Section (ASEWS) – food security (MAL / ZMD/CSO) | E-mail, print media, agricultural extension officers |
| Flood forecasting (DWA / ZRA / ZESCO) | E-mail / telephone to DMMU, NGOs and local authorities |
| Disease and epidemics (MoH) | From Lusaka HQ via provincial/district departments/offices to communities |
| Flash Flood Guidance System (ZMD / DWA) – under investigation | Under investigation |

131. A number of development partners and projects in Zambia are investing in providing disaster risk reduction to support the DMMU and community-based early warning support for local communities. Additional support is required for ensuring the efficacy of these support measures and investments under a changing climate. There is in particular a need to consolidate and streamline the current dissemination channels and ensure that on-going activities are coordinated. Additionally, innovative mechanisms for sustaining weather and climate forecasting and warning systems under a changing climate are required.

132. To ensure that the LDCF funds are used in a strategic manner, the LDCF outputs under Outcome 2 will not only be linked to – and closely coordinated with – meteorological services baseline projects described under Outcome 1, but will also build upon additional baseline projects (described in Section 2.3)focused on disaster risk reduction, community-based early warning systems and developing mobile alerts communication systems for severe weather alerts. The specific links to these baseline project are described below under the "Adaptation Alternative" for Outcome 2.

*Adaptation alternative (with LDCF project)*

133. Despite the achievements of the GRZand the support of the baseline projects outlined under Outcome 1 and 2, additional support is required tostrengthen coordination procedures and communication channels for sharing and disseminating weather and climate information to decision makers in government, private sector, civil society, development partners and local communities. This will result in a streamlined, coordinated approach to the national EWS in Zambia.

134. Without additional support, the effectiveness of the current centralized and decentralized EWSs, as well as disaster risk reduction activities in Zambia – including local communities and socio-economic sectors supported by these activities and projects – will be undermined by climate change impacts, particularly an increase in intensity and frequency of extreme weather and climate events.

135. The **four outputs** under Outcome 2 will build on the existing investments being made in the sector by the GRZ including a donor-supported baseline project (though the GRZ/UNDP project described in Section 2.3).

- LDCF resources will build on GRZEWS efforts within DMMU and be used tostrengthen the provision of tailored, sector-specific flood and drought (primarily) as well as health and other climate-related warnings and information. The issuance of warnings will be through a central facility housed with DMMU. Information will be fed into DMMU's information management system and database, and disseminated through standard communication channels. This will be guided by SOPs and inter-ministerial collaboration guidelines established through Output 2.1.

- Weather and climate information will be mainstreamed into national policies, annual workplans and local development plans, including the Seventh National Development Plan, and district development plans in priority districts of Chipata, Gwembe and Sesheke (though Output 2.2). This will build on the achievements of the GRZ/UN Joint Programme and in particular complement the outcome of Outputs 3 and 4 through the provision of improved weather and climate data and associated forecasts and early warnings:
    - Joint Programme Output 3: Government has effectively developed strategies, action plans and systems, and enforced related legal frameworks, for mounting asectoral and multi-level response to climate change according to international and regional standards.
    - Joint Programme Outcome 4: Stakeholders and beneficiaries at local levels have access to adaptive technology and sustainable production practices for climate resilient and environmentally friendly livelihoods.

136. The link between the national dissemination of early warnings to sector end-users and the decentralized, local level dissemination to vulnerable communities will be strengthened. This will be achieved by implementing two-way, mobile phone-based EWSs in the priority districts of Chipata, Gwembe and Sesheke. This will include an assessment of local knowledge on indigenous early warnings, as well as the testing of various communication methods. The results of the local level implementation will inform the upscaling of dissemination of relevant information to other vulnerable districts and communities in Zambia. Activities will build on GRZ-funded DMMU activities to develop on-the-ground capacity to engage with vulnerable communities. This includes synergising with PPCR activities aimed at strengthening the provision of climate information, more specifically on: i) a social marketing awareness campaign to raise awareness on the importance of climate information; and ii) strengthening EWSs piloted in selected districts in the Barotse and Kafue sub-basins.

137. Furthermore, innovative financing options – including public-private partnerships and market-based mechanisms – will be identified, developed and promoted for providing sustainable finance for the operation and maintenance of the installed meteorological observation, forecasting and early warning systems. This will align withPPCR activities focused on climate change adaptation in the private sector.

**Output 2.1**: Tailored, sector-specific weather and climate information made accessible to decision makers in government, private sector, civil society, development partners and local communities.

138. Activities under this output will focus on the generation of tailored, sector-specific weather and climate information using the improved data supplied by ZMD. The tailored information products – including alerts, risk and vulnerability maps, and results from an integrated cost-benefit analysis – will be developed through consultations with end-users and appropriate research organizations (such as UNZA). Furthermore, this will be informed by a comprehensive assessment of best practices and gaps with regards to centralized and decentralized climate information and early warning systems in Zambia and internationally. Interactions between ZMD, DMMU, DWA/WRMA, MAL, MoH and CSO will be strengthened to design and disseminate tailored information through an online weather and climate information platform housed at the DMMU and managed by the NEWDMC and associated technical committees. This platform will provide technical as well as non-technical information to end-users. When the information consistutes a warning, this will be disseminated through the channels established through Output 2.3.

Output 2.1 includes the following indicative **activities**:

**2.1.1** Undertake a comprehensive assessment of existing, tailored (if any) climate information available to the agricultural, water and energy, health and other climate-sensitive sectors – including information exchange mechanisms, communication channels and dissemination mechanisms between

ZMD, user agencies and end-users – to establish best practices, gaps and opportunities for streamlining and collaboration on data-use and -sharing.

**2.1.2** Develop the capacity of 3 technical personnel from each of DMMU, DWA/WRMA, MAL, MoH and CSO to – in collaboration with ZMD – produce climate risk and vulnerability sector-specific maps and resultant tailored information (to be disseminated via e-mail, online platform, print media and extension services) and warnings (to be disseminated through DMMU) using the improved climate information available from ZMD. This will include the development of SOPs for the generation of such information, and a "train the trainer" approach whereby the 3 personnel trained per institution develop the capacity of staff at their respective institutions.

**2.1.3** Develop a statutory regulatory framework to guide information sharing and analysis between the institutions listed in Activity 2.1.2 (including ZMD), to generate tailored, sector-specific information. This framework will guide the dissemination of: i) sector-specific climate information (via e-mail, online platform, print media and extension services); and ii) climate-related warnings (through DMMU via the communication channels implemented in Outcome 2.3). This regulatory framework will guide the use of and access to improved climate data (collected and held by ZMD) by DMMU, DWA/WRMA, MAL, MoH and CSO, and will be based upon the mandates of all collaborating institutions.

**2.1.4** Evaluate the costs and benefits of accurate, timely and accessible tailored, sector-specific information, based on improved weather and climate data, and develop handbooks and policy and information briefs to highlight the value of enhanced meteorological services and early warning systems to policy and decision-makers, civil society organisations, development partners and local communities. This will include household surveys of a subset of targeted users of climate information in the priority districts of Chipata, Gwembe and Sesheke conducted to understand the social and economic costs and benefits of using advisories and warnings for *ex-ante* risk management in agriculture and water management.

**2.1.5** Build the human and technical capacity of the DMMU, through the NEWDMC and associated technical committees, to facilitate inter-sectoral sharing of tailored, sector-specific forecasts and information, generated by ZMD in collaboration with the respective line ministries. This sharing will be achieved through an online platform linked to the currently installed ZEPRIS. When the tailored, sector-specific information results in a warning, as assessed by DMMU, MAL, DWA/WRMA, MoH and CSO (based on the capacity building provided through Activity 2.1.2) the warning will be disseminated by DMMU through the structures established in Output 2.3.

**Output 2.2**: National capacity developed for assimilating weather and climate information into existing national policies, development plans and disaster management systems.

139. LDCF resources will be used to mainstream weather and climate information and early warning systems into the National Development Plan and Disaster Management Policy and downscale these to local levels in priority districts of Chipata, Gwembe and Sesheke. Revisions will be proposed to water, agriculture and environmental sectoral policies and annual workplans, using weather and climate information products developed under Output 2.1. Guidelines will be developed and capacity building undertaken for local governments agencies in the priority districts of Chipata, Gwembe and Sesheke for integrating weather and climate information products designed in Output 2.1.

Output 2.2 includes the following indicative **activities**:

**2.2.1** Identify, review and propose revisions to water, agriculture and environment sectoral policies, strategies, investment plans and annual workplans to make provisions to incorporate weather and climate information into long-term and strategic planning.

**2.2.2** Develop and implement protocols for integrating weather and climate information into the National Development Plan and Disaster Management Policy and downscale these to local levels in priority districts of Chipata, Gwembe and Sesheke.

**2.2.3** Develop the capacity of ZMD, DMMU, MAL, DWA/WRMA, MoH and CSO and associated line ministries, departments and agencies to integrate weather and climate information into annual workplans. This will be achieved through a series of workshops, led by national policy and strategy advisors.

**2.2.4** Develop the capacity of local (district) government user agencies through training and thematic workshops to effectively support the use of the improved climate information and advisories in revisions to local level development plans. This activity will focus on local government agencies in the priority districts of Chipata, Gwembe and Sesheke. Guidelines will be developed to assist with the upscaling of capacity development to other vulnerable districts in Zambia.

**Output 2.3** Communication channels and procedures for issuing warnings are enabled at a national level, and implemented at a district level through the development of mobile phone-based alert platforms in the priority districts of Chipata, Gwembe and Sesheke.

140. Under Output 2.3, a national weather and climate information and early warning system communication and coordination strategy will be developed to coordinate decision-makers in government, private sector, civil society and development partners in the communication of weather and climate alerts to vulnerable sectors and local communities. SOPs (including protocols and inter-ministerial agreements) for disseminating weather and climate information including alerts across all levels will be developed. This will be complemented by an early warning system dissemination toolbox, which will include a trainer manual on the use of a range of national and local media for disseminating weather and climate information alerts to end-users.

141. A two-way, SMS-based alert system will be implemented in the priority districts of Chipata, Gwembe and Sesheke by DMMU. The two-way system will provide: i) alerts to local communities at risk; and ii) a communication channel to disseminate feedback on the usefulness and impact of the alert received as well as the current status of the particular weather or climate extreme being experienced. Communities will be engaged in the development of the alert system to ensure that indigenous knowledge is incorporated and to ensure that the community is able to respond to the advisories issued – this will entail building the capacity of community leaders and farmers. This will be done in collaboration with the PPCR project, which is implementing a similar system in 8 districts in the Kafue Sub-basin through funding from the WB. Warnings issued in the Kafue Sub-basin will be informed by the improved weather and climate forecasts generated through the LDCF project.

Output 2.3 includes the following indicative **activities**:

**2.3.1** Develop a national weather and climate information and early warning system communication and coordination strategy. This will include SOPs for disseminating weather and climate information including alerts across all levels, e.g. community-level, local-level, state/province-level and national level.

**2.3.2** Develop an early warning system dissemination national and local toolbox including a trainer manual on the use of radio, television, print media, SMS-based alerts, satellite phones, mobile/smart phone and local, indigenous methods used to alert communities of climate-related hazards in Zambia.

**2.3.3** Undertake field visits and stakeholder consultations in a subset of targeted users in the priority districts of Chipata, Gwembe and Sesheke to understand how users of early warning advisories and warnings use the information for managing climate and weather related risks and how their decision frameworks affect the interpretation of advisories and warnings.

**2.3.4** Map sub-basin climate hazards in the priority districts of Chipata, Gwembe and Sesheke, including geospatial interpretation and groundtruthing. This will inform the development of tailored and area-specific warnings and the generation of alerts for the three districts.

**2.3.5** Establish an Open Data Platform including server and software for SMS alert system, tailored to the priority districts of Chipata, Gwembe and Sesheke.

**2.3.6** Implement a two-way, SMS-based alert system in the priority districts of Chipata, Gwembe and Sesheke including community engagement, community training, inclusion of indigenous knowledge, development of data quality and SMS thresholds (for the provision of warnings and information feedback) and Crowdsource Information Technology (IT) specialist and maintenance support. The EWS will include the provision of primarily flood and drought warnings, but also health and other climate-related warnings generated through the activities of Output 2.1.

**Output 2.4** Public-private partnership developed for sustainable financing of the operation and maintenance of the installed meteorological observation network.

142. Output 2.4 focuses on developing and implementing innovative financing options for enhancing the long-term functionality and sustainability of the meteorological observation network installed and upgraded through the LDCF project. The insurance sector requires climate information to develop weather index-based insurance products to sell to private sector farmers and agricultural investors. The viability of weather index-based insurance products, in terms of demand and profitability to the insurance sector, has been investigated through an IFC-led study as part of the PPCR[27]. The Insurers Association of Zambia has indicated a willingness to engage in discussions regarding the funding of operation and maintenance activities to ensure the sustainability of a meteorological observation network in Zambia. This is because the insurance sector recognizes the value of accurate, reliable weather and climate data in informing weather index-based insurance products. The sector further realizes that ZMD has historically been unable to maintain the national meteorological observation network, meaning currently available data is inadequate to reliably offer associated insurance products.

143. The LDCF project will facilitate a public-private partnership between an insurance company and the ZMD, through its Instruments Division, which is responsible for the installation, maintenance, calibration, fabrication and standardisation of all meteorological instruments. This will include a call for proposals from the insurance sector, inviting concepts on how the partnership would be structured and what the division of responsibilities will be. This call for proposals will capitalise on the interest generated through the IFC PPCR work in the Kafue and Barotse sub-basins. This partnership will guarantee the maintenance and sustained operation of the meteorological observation network beyond the duration of the LDCF project.

144. While the focus of this output is on the insurance sector and weather-based index insurance, activties will include an analysis of other private sector stakeholders and the potential demand for improved climate information. This will include the potential of establishing additional public-private partnerships which could contribute to generating revenue to cover the costs of sustaining the meterological observation network established through the LDCF project.

Output 2.4 includes the following **activities**:

**2.4.1** Undertake a review of the private sector demand for improved climate information in Zambia. This will include, but not be limited to, the agriculture insurance sector, building on the work of the

[27]Report under preparation. Pers. comm., Anthony Mills, IFC Sustainable Business Advisory – Africa.

IFC through the PPCR, to understand the climate information needs and market for weather index-based insurance.

**2.4.2** Develop a Terms of Reference and issue a call for proposals from the insurance and/or other sectors to establish a public-private partnership with the ZMD (Instruments Division) to maintain the meteorological observation network (both existing and established though the LDCF project). For the insurance sector, this will be aimed at generating commercially viable weather index-based insurance products.

**2.4.3** Establish the public-private partnership between the company selected from the response to Activity 2.4.2 and the ZMD (Instruments Division). This will include the establishment of SOPs and agreements to allow the private sector company to use the data generated by the meteorological observation network for the purpose of selling products to the private sector e.g. selling weather index-based insurance products to private sector farmers.

## 2.5. Key indicators, risks and assumptions

### *2.5.1 Indicators*

145. The indicators are designed to measure change in the coverage, impact, sustainability and replicability of the LDCF project. These indicators track progress in achieving project objective and outcomes. The baseline, target, source of verification, risks and assumption per indicator are detailed in the Project Results Framework (see Section 3). Baseline values and targets per indicator will be verified within the first six months of project implementation.

146. At the level of the project objective and the two project outcomes, indicators are:

**Objective: To strengthen the climate monitoring capabilities, early warning systems and available information for responding to climate shocks and planning adaptation to climate change in Zambia.**

**Indicators:**
1. Capacity as per capacity assessment scorecard.
2. Domestic finance committed to ZMD and DMMU to monitor, forecast and warn against extreme weather and climate change.

**Outcome 1: Enhanced capacity of Zambia Meteorological Department to monitor and forecast extreme weather and climate change.**

**Indicators:**
1. Percentage of national coverage of climate monitoring network (fully operational).
2. Frequency of data transmission and reception.

**Outcome 2:Efficient and effective use of hydro-meteorological and environmental information for making early warnings and long-term development plans.**

**Indicators:**
1. Percentage of population in Chipata, Gwembe and Sesheke Districts with access to improved climate-related flood and drought hazard warnings (disaggregated by gender).
2. Development frameworks and disaster policies and that integrate climate information in the formulation.
3. Sector-specific, tailored climate information packages that integrate climate risks.

### *2.5.2 Risks, mitigation/reduction measures and assumptions*

147. Risks, mitigation/reduction measures and assumptions to/of the LDCF project are summarised in Table 7 below, and assigned to indicators in the Project Results Framework (see Section 3). The risks are further detailed in the Risk Log in Annex 4.

**Table 7**: LDCF project risks, mitigation/reduction measures and assumptions.

| # | Risk | Mitigation/reduction measure | Assumption |
|---|---|---|---|
| 1 | Human, technical capacity within DMMU, ZMD, MAL, DWA/WRMA, MoH and CSO, including within extension service providers and decentralised offices, is insufficient to effectively implement the LDCF project. | The capacity of technicians within DMMU, ZMD, MAL, DWA/WRMA, MoH and CSO is developed through training opportunities provided through the LDFC project. | Training opportunities provided through the LDCF project result in the development of the required capacity, and the government provides the necessary budget to provide the required institutional framework in which the newly skilled staff can operate. |
| 2 | Poor coordination and information sharing structures/agreements between IP (ZMD), RPs (DMMU, DWA/WRMA, MAL, MoH, CSO and INCCS) and UNDP CO results in institutional failure, compartmentalized progress and delayed implementation of the LDCF project. | A project organisation structure (see Section 5) is implemented including representation of MTWSC (ZMD), DMMU and UNDP on the Project Board. These three institutions will steer the LDCF project and ensure that a coordinated approach is adopted. | The management arrangements established through the LDCF project result in a coordinated approach to implementing the project. |
| 3 | Insufficient institutional support and political commitments from the government leads to a decrease in the political will ensured during project design, ultimately destabilizing the LDCF project. | Continuous lobbying and sensitization of the key government officials will be undertaken based on evidence from the pilot sites to secure cooperation and commitment. | Government commitment established during the design phase of the LDCF project is maintained for the project duration. |
| 4 | The slow pace of policy modification means that identified development frameworks do not integrate climate change in a timely fashion. | Continuous lobbying and sensitization of the policy makers will be undertaken based on evidence from the pilot sites to secure cooperation and commitment. | Climate change adaptation considerations are included in development framework formulation, based on advancements in climate information and forecasting achieved through the LDCF project. |
| 5 | Delayed implementation of baseline projects by the government and donors negatively affects LDCF project outcomes. | The PM will work closely with the relevant persons responsible for the baseline projects to synergise activities and assist in facilitating the implementation of baseline projects where possible. | Baseline projects are implemented according to the timeline identified in the design phase of the LDCF project, and achieve the desired outcomes and objectives. |
| 6 | Installed hydro-meteorological equipment fails because it is vandalised or not maintained. | Awareness raising activities will be undertaken in target communities to highlight the importance of the installed equipment. In addition, the equipment will be housed within a secure fence. | Communities living in proximity to installed hydro-meteorological equipment commit to taking active measures to prevent the equipment from being vandalised; and the equipment is adequately maintained by the responsible institution. |
| 7 | Climate shocks occurring during the design and implementation phase of the LDCF project result in disruptions to installed | Disaster mitigation and response activities will be prioritized at the target communities whilst the EWS is being established. | Any climate shocks occurring whilst the EWSs are being established will not be so severe as to result in a relocation of the |

| # | Risk | Mitigation/reduction measure | Assumption |
|---|---|---|---|
| | equipment and severely affect communities, prior to the EWSs being established. | | communities where the effectiveness of the EWSs will be tested, or to irreparably damage hydro-meteorological equipment. |
| 8 | Local information technology and telecommunications infrastructure restricts the transfer of data from installed equipment to necessary recipients, and restricts communication amongst key role players and end-users. | The LDCF project has been designed in accordance with local conditions, taking, where applicable, the latest available international technology into account. | Information technologies and telecommunications systems implemented or used through the LDCF project are best suited to the local context and do not restrict the transfer and communication of information. |
| 9 | Procurement and installation of hydro-meteorological equipment, including hardware and software, is delayed because of complications with the release of funds and/or national procurement procedures. | Effective administrative planning will be undertaken, with support from UNDP CO, which will include procuring equipment at an early stage in the project implementation phase. | UNDP CO and HQ will co-ordinate with the IP to ensure effective administrative planning and the timely procurement and installation of equipment. |
| 10 | Lack of commitment from communities where EWS are established undermines the effectiveness of the LDCF project demonstrations. | The LDCF project will avoid a 'top down' approach and seek to create community ownership of the EWSs through community training and encouraging participation in project activities. | Awareness-raising activities and the demonstration of the advantages of responding to the information provided through the established EWS will ensure the commitment of the communities participating in the LDCF project. |

## 2.6. Cost-effectiveness

148. Quantifying the cost effectiveness of improved climate information and early warning system investments is acknowledged to be difficult, and is therefore not regularly undertaken[28]. Cost-benefit analyses of investments in improved climate monitoring and effective early warning systems are scarce. However, evidence suggests that investment in prevention is more cost-effective than spending on relief[29]. In developed countries in general, the benefits of improved weather services to inform severe weather warnings exceed costs by an average of more than 10 times (taken from Tsirkunov and Rogers, 2010)[30]. There is potential for similar cost-benefits to be realised through investing in improved climate monitoring and early warnings systems in developing countries. These benefits are expected to be proportional to: i) the population of the country; ii) level of climate-related risk; and iii) exposure to weather due to the state of infrastructure. It is estimated that, for all developing countries, the benefits of improved hydro-meteorological information, production of early warnings and associated capacity building/development will be[31]:

- between US$ 300 million and US$ 2 billion per year of avoided asset losses due to climate change-induced disasters;
- an average of 23,000 saved lives per year, which is valued between US$ 700 million and US$ 3.5 billion per year using the Copenhagen Consensus guidelines; and
- between US$ 3 and US$ 30 billion per year of additional economic benefits.

[28]Tsirkunov, V. and Rogers, D. 2010.Costs and benefits of early warning systems.Global Assessment report on Disaster Risk Reduction.The World Bank.

[29]Healy, A. and Malhotra, N. 2009.Myopic Voters and Natural Disaster Policy. *The American Political Science Review* 103(3): 387-406.

[30]Tsirkunov, V. and Rogers, D. 2010.Costs and benefits of early warning systems. Global Assessment report on Disaster Risk Reduction. The World Bank.

[31]Hallegatte, S. 2012. A Cost Effective Solution to Reduce Disaster Losses in Developing Countries: Hydro-Meteorological Services, Early Warning, and Evacuation. Policy Research Working paper 6058. The World Bank.

149. The total benefits are estimated to be between US$ 4 and US$ 36 billion per year. The cost of improving hydro-meteorological services and producing the required warnings is estimated to be lower than US$ 1 billion. The benefit-cost ratio is thus, on average for developing countries, between 4 and 36. The objective of the LDCF project is to strengthen climate monitoring capabilities through the installation of weather monitoring equipment to inform early warning systems, and for planning for adaptation to climate change. However, there are various approaches that could be adopted to achieve this objective. The proposed outputs and procurement purchases of the LDCF project were assessed, in collaboration with government stakeholders, for cost-effectiveness and sustainability of investments and weighed against alternative approaches. In some instances, investments in technologically advanced equipment and techniques e.g. repairing and installing radar technologies, were considered too expensive to be implemented through the LDCF project and have been disregarded in favour of investments in cost-effective and sustainable technologies.

150. The approach taken to ensure cost-effectiveness of the LDCF project's outcomes is detailed further below and in Table 8.

Outcome 1. Enhanced capacity of ZMDto monitor and forecast extreme weather and climate change.

151. LDCF project activities will build on existing networks, achievements and planned actions by ZMD and DWA/WRMA. This will allow institutional capacity to be built cost-effectively, ultimately assisting in planning and implementing the early warning system. This approach of complementing existing, related projects is more cost-effective than if the implementation of a separate initiative, as it will allow the LDCF project to be managed within the existing institutional and management frameworks. The LDCF project will also work closely with existing DMMU, ZMD and DWA/WRMA projects to co-produce outputs. This will promote cost-sharing with these other projects, reducing overheads and enhancing cost-effectiveness. The LDCF project will also develop sustainable financing mechanisms to support the operation and maintenance of the improved hydro-meteorological network. In particular, there is potential for improved early warning services and tailored forecasts to generate revenue from the aviation and commercial agriculture sectors.

152. Equipment purchases and repairs to existing infrastructure were evaluated for cost-effectiveness. In order to maximise the geographic coverage of the hydro-meteorological network, a large proportion of existing infrastructure will be rehabilitated in addition to the procurement of new AWSs. Stakeholders within the ZMD and DWA/WRMA were consulted extensively on the likely extent of training that would be required for personnel to operate various equipment types in order to ensure that training as well as procurement was included in cost-effectiveness considerations.

Outcome 2. Efficient and effective use of hydro-meteorological and environmental information for making early warnings and long-term development plans.

153. Lessons learned from on-the-ground climate monitoring and early warning interventions will be captured and disseminated through inter alia: i) in-house training for technicians; ii) an online platform for the dissemination of tailored information/forecasts and warnings; and iii) a toolbox that will include courses, handbooks and manuals. This integrated approach provides a cost-effective manner of informing and increasing the capacity of an extensive range of stakeholders, which include government technical staff, policy-makers, restoration practitioners, scientists, university students, school children and the general public.

154. A baseline self-capacity assessment was conducted during the project preparation phase in order to guide the identification and prioritisation of stakeholder needs. Equipment and capacity-building investments were selected based on identified priorities as well as the available budget and focal areas of the LDCF project. Proposed outputs and procurements were reviewed in a representative validation workshop and revised to reflect considerations of sustainability and cost-

effectiveness. Proposed outputs are considered cost-effective relative to the alternative approaches considered to address project barriers, as shown in Table 8 below.

155. This LDCF project is not a standalone project; it is part of a wider multi-country programme that will implement similar initiatives on generating climate information and Early Warning Systems in at least 10 countries in Africa (including Benin, Burkina Faso, Ethiopia, Liberia, Malawi, Sierra Leone, São Tomé & Príncipe, Tanzania, Uganda and Zambia). Synergy between these projects will enhance the cost-effectiveness of hiring of specialized technical staff, coordination of data and information (including inter-country sharing where feasible) and training (operations & maintenance of equipment; forecasting techniques; tailored advisories and warnings). It will also ensure effective use of communications and standard operating procedures.

156. A common priority that was identified in all project countries was the need to provide training and capacity building for operation and maintenance of the newly enhanced hydro-meteorological infrastructure and for modeling and forecasting (Outputs 1.2, 1.3 and 1.4). Training and capacity-building activities will be undertaken at a regional level. This approach of enhancing skills in all project countries simultaneously will have several benefits in addition to enhancing cost-effectiveness. Bringing stakeholders from all project countries together will: i) encourage knowledge sharing and the development of collective skills; ii) promote the sharing of information between countries, regarding best practices and lessons learned; and iii) increase the size of the pool of skilled resources which each country can draw upon, thereby increasing the likelihood of future training workshops to be conducted by experts within the region. Regional training and capacity-building activities will be closely coordinated with other regional and international partners/centres including *inter alia* ACMAD, SARCOF, AfriGEOSS, AMESD, MESA and WMO's GFCS initiative.

157. After surveying the technical support needs for each country a set of common specialized technical staff were identified, each with particular skills related to: i) the development of hydroclimatic observing systems; ii) the effective design and implementation of standard operating procedures; iii) tailored warnings/advisories; and iv) the communication of advisories/warnings. Hiring 3 or 4 full-time technical staff, which can provide the needed support for all countries, will be more cost-effective than hiring consultants for each country and all projects will benefit from the diverse technical support that will be provided. Further benefits include time saved on HR procurement procedures (e.g. for hiring, advertising etc.) and the ability to compare and standardize support across countries where possible. UNDP will directly undertake the recruitment for all project staff which will support all countries in this multi-country programme

158. A regional approach will also help strengthen the development of standard operating procedures (both protocols and the legal basis of inter-ministerial agreements) in Outputs 2.1, 2.2, 2.3 and 2.4. In Zambia, such standard operating procedures include those for: i) developing climate risk and sector-specific vulnerability maps and resultant tailored information and warnings using improved information (Output 2.1); ii) sharing and analyzing hydro-meteorological data and information (Output 2.1); iii) integrating weather and climate information into development policies and plans (Output 2.2); iv) disseminating of and responding to weather and climate information and warnings (Output 2.3); and v) allowing the private sector to use data generated by the hydro-meteorological observation network (Output 2.4). A regional approach will allow Zambia to benefit from experiences and development/implementation of standard operating procedures in other countries in the region, which in turn will benefit from Zambia-specific actions. In addition, capacity building/development workshops will be undertaken at a regional level. This will allow all project countries to benefit from shared information, lessons learned and best-practices, and will be more cost-effective as costs such as workshop facilities and accommodation, hiring technically skilled trainers and purchasing/developing appropriate training materials can be shared between the countries. For example, the training of senior climatologists, analysts, weather forecasters and researchers (Output 1.4 for Zambia) to produce forecasts and develop tailored hydro-meteorological information can be undertaken through regional workshops, as this is a training requirement for most countries.

159. All projects under this programme will develop a sustainable financing strategy for ongoing operation and maintenance of the newly enhanced hydro-meteorological networks. These strategies may include leveraging financing and logistic support from private sector companies and relevant sectors. In the instance of Zambia, specific sectors that the ZMD aims to align with (Output 2.4) include, but are not limited to, the agricultural insurance sector, particularly weather-based index insurance for private sector farmers and agricultural investors. Where private sector engagement includes multi-national corporations, regional support will assist in engaging head offices in multiple countries. This will increase the total effective services being offered and the bargaining position of each government. In the case of mobile (cellular) communications (which will be used for both disseminating alerts and the collection of data used to generate alerts), the regional support programme will leverage collective negotiations for data services. The programme will also engage with corporate social responsibility programmes of multi-national corporations to enhance services where possible. This is a more cost effective approach than were the 10 individual countries to approach such corporations individually.

**Table 8**: Comparison of LDCF project outputs and alternates considered.

| Output | Barrier Addressed | Alternatives Considered |
|---|---|---|
| **Output 1.1** 28 Automatic Weather Stations procured and installed, and 41 existing manual and automatic monitoring stations rehabilitated. | Inadequate weather and climate monitoring infrastructure, which limits data collection, detection of climate trends, analysis and provision of timely meteorological services.<br><br>Limited knowledge and capacity to effectively monitor and predict future weather and climate events as a result of an acute shortage of technology and skilled human resources, as well as access to climate models and hardware. | **Alternative 1:** Only use manual stations and incorporate SMS communication services, using the existing capacity to monitor and report data with familiar and user-friendly equipment. Automated data collection is necessary in order to generate timely alerts, particularly at night when manual stations will not be monitoring or reporting data.<br><br>**Alternative 2:** Expansion of the meteorological monitoring network through procurement of only new Automatic and Manual Stations. However, the costs and technical challenges of maintaining a dramatically expanded automated monitoring system is unlikely to be sustainable given the limited availability of maintenance funding and suitable qualified technicians. Therefore an emphasis on rehabilitation of existing infrastructure, as well as procurement of new equipment, has been adopted.<br><br>**Alternative 3:** Lightning detection systems. At present, there is considerable variability around the costing for lightning detection systems. Besides startup costs, which in some cases are a significant portion of the project budget, the costs of implementing new technologies, training and maintenance, as well the requirement for ground based observations (for calibration) and the untested nature of the technology in Africa were significant concerns.<br><br>**Alternative 4:** The rehabilitation and installation of radar technologies has the potential to generate high-quality spatial data of various weather indices in near-real-time. However the high costs and extensive technical capacity requirements for operation and maintenance of these technologies suggest that investments in simpler, more fundamental skills and technologies would be more sustainable and appropriate to the local context. |

| | | |
|---|---|---|
| **Output 1.2** Weather and climate forecasting systems upgraded, including the installation of the required hardware and software and integration of satellite observations. | Inadequate weather and climate monitoring infrastructure, which limits data collection, analysis and provision of timely meteorological services.<br><br>Limited knowledge and capacity to effectively predict future weather and climate events as a result of an acute shortage of technology and skilled human resources, as well as access to climate models and hardware. | **Alternative 1:** Ongoing and planned monitoring, forecasts and EWS initiatives will continue to operate independently. Moderate investments could be directed to restoring the functionality of existing facilities. However, this will not result in a modernization of the hydro-meteorological monitoring and forecasting system and there will be only a limited development of national capacity as a result of LDCF investments. Furthermore, if existing facilities are not appropriately modernized and data is not readily accessible to various stakeholders, it will be challenging to incorporate other user-agencies of weather, climate and hydrological information such as DMMU, DWA, WRMA, MAL, MoH, CSO and INCCS.<br><br>**Alternative 2:** Forecasting and data management capacity is sourced offshore. However this is not popular with GRZ as this places data (which is considered a national asset) offshore and does not build local human and technical capacities. |
| **Output 1.3** Capacity developed for operating and maintaining the climate observation network and related infrastructure including the training of 10 engineers, 10 technicians and local communities to maintain and repair meteorological equipment, computer infrastructure and telecommunications network. | Inadequate weather and climate monitoring infrastructure, which limits data collection, analysis and provision of timely meteorological services.<br><br>Long-term sustainability of observational infrastructure and technically skilled human resources to maintain it because of inadequate GRZ and/or private sector funding. | **Alternative 1:** All operation and maintenance can be outsourced to a private company through a PPP (public private partnership) to enable the company time to train information production personnel over a longer period of time. However, local stakeholders are already experienced with the equipment that will be used in the rehabilitated monitoring network and can make use of previous experience in training personnel.<br><br>**Alternative 2:** Technical capacity of personnel could be built through regional and international training centers. However this option may be less cost-effective because it does not capitalize on the existing internal forecasting and training expertise within ZMD and DMMU and will reduce the upscaling of technical capacity built through the LDCF project. |

| | | |
|---|---|---|
| **Output 1.4** Technical capacity of ZMD is developed to improve the production of standard and customized weather and climate forecasts and packaging meteorological data and information into a suitable format for user agencies and local community end-users. | Limited knowledge and capacity to effectively project future climate events as a result of an acute shortage of technology and skilled human resources, as well as access to climate models and hardware.<br><br>Weak institutional coordination between institutions leading to limited packaging, translating and disseminating climate information and warnings.<br><br>Low community level uptake of warnings, advisories and available climate/weather information. | **Alternative 1:** Generalised weather and climate forecasts can continue to be produced at periodic intervals with comparatively little economic investment. However the limited availability of tailored sector-specific climate information packages is likely to result in a low level of use of climate information as the data is not directly applicable to many end users.<br><br>**Alternative 2:** Only regional and international products are used. This would reduce their applicability and usefulness within the districts and sectors targeted in Zambia. |
| **Output 2.1**Tailored, sector-specific weather and climate information made accessible to decision makers in government, private sector, civil society, development partners and local communities. | Weak institutional coordination between institutions leading to limited packaging, translating and disseminating climate information and warnings.<br><br>Low community level uptake of warnings, advisories and available climate/weather information. | **Alternative 1:** Generalised weather and climate forecasts can continue to be produced at periodic intervals with comparatively little economic investment. However the limited availability of tailored sector-specific climate information packages is likely to result in a low level of use of climate information as the data is not directly applicable to many end users.<br><br>**Alternative 2:** Allow decision-makers to receive their information independently through current sources. With this option, there is no central focal point for reporting information and to clarify disaster prevention strategies. Also, there would be no standards applied to the generation and packaging of information. Thus, information would not have consistency in terms of content and quality. This would lead to poor coordination of strategies and DRR activities, resulting in duplication of efforts and/or gaps in delivery of DRR services.<br><br>**Alternative 3:** Rely on additional infrastructure (e.g. rehabilitated and newly installed weather stations) to improve information generation. However, while the additional infrastructure allows improvements in the gathering of information, without tailoring the information may be of limited value to decision-makers in the various sectors. The decision-maker will not have access to sector-specific information that would guide planning and budgeting. |

| | | |
|---|---|---|
| **Output 2.2**National capacity developed for assimilating weather and climate information into existing national policies, development plans and disaster management systems. | Limited knowledge and capacity to effectively project future climate events as a result of an acute shortage of technology and skilled human resources, as well as access to climate models and hardware.<br><br>Weak institutional coordination between institutions leading to limited packaging, translating and disseminating climate information and warnings. | **Alternative 1:** Allow national, district and local policy-making and planning to continue under present *modus operandi*. This would perpetuate the current reactive approach to climate change adaptation and disaster risk management planning. This would result in poor coordination of early warning-related planning and implementation across all levels, leading to duplication of efforts and/or gaps in delivery of services (especially in localized flood, drought and extreme weather management and relief efforts). |
| **Output 2.3** Communication channels and procedures for issuing warnings are enabled at a national level, and implemented at a district level through the development of mobile phone-based alert platforms in the priority districts of Chipata, Gwembe and Sesheke. | Limited knowledge and capacity to effectively project future climate events as a result of an acute shortage of technology and skilled human resources, as well as access to climate models and hardware. This means climate information and warnings do not reach those who need the information, either because there is no access to technology or inappropriate communications and terminology are used.<br><br>Weak institutional coordination between institutions leading to limited packaging, translating and disseminating climate information and warnings.<br><br>Low community level uptake of warnings, advisories and available climate/weather information. | **Alternative 1:** Continue using present communication channels and procedures for issuing alerts. This would result in a poor coordination of alerts being issued. Also, there would be no standards in terms of *inter alia* protocols, content, timing and modalities of alerts. Consequently, alerts may contain insufficient information, be of poor quality, not reach the proper recipients, and/or be transmitted/received too late. Have separate data portals for each agency to ensure security: however, this would prohibit the easy use of data across agencies and a potential means to share data internationally. |
| **Output 2.4** Public-private partnership developed for sustainable financing of the operation and maintenance of the installed meteorological observation network. | Long-term sustainability of observational infrastructure and technically skilled human resources is threatened. GRZ agencies are unable to grow and develop services to generate revenue. | **Alternative 1:** Operation and maintenance of upgraded hydro-meteorological network can be financed purely through allocation of public budgets. However this will reduce the participation of various socio-economic sectors in the development of tailored forecasts and EWS services i.e. reduce dialogue regarding most vulnerable services. Furthermore, the limited availability of funding from ZMD and DWA/WRMA budgets is likely to affect the efficacy and sustainability of the LDCF project's investments. |

## 2.7. Sustainability

160. To sustain the LDCF project interventions beyond the project implementation period, ownership of the LDCF project by government structures (primarily DMMU and ZMD) is essential. Consequently, relevant government departments, as well as local communities, need to be involved in the design and implementation of project interventions. This participatory approach has been initiated through collaboration with national government departments in designing the LDCF project approach and interventions. Implementation of the LDCF project activities will include technical capacity building focused on appropriate government departments that will coordinate and/or support the implementation of the LDCF project. Furthermore, local communities will be consulted during the development of early warning systems in Chipata, Gwembe and Sesheke Districts.The LDCF project will thereby address needs identified by local communities which will instil community ownership of the project's activities. Government staff will be involved in these community capacity building exercises, and as a result the capacity of government staff working within the project to develop and implement climate information and early warning-related measures will be significantly strengthened, which will be beneficial for future projects within Zambia.

161. To further strengthen the sustainability of the LDCF project, interventions will be implemented in a phased approach. This applies to the development of human technical capacity as well as to installing meteorological equipment. Lessons learned as the equipment is installed will be used to inform future installations, and capacity developed in government staff will be used to build in-house capacity of other personnel through employing a 'train the trainers' approach. Additionally,agreements will be established with individuals who receive training in orderto ensure that they remain in the relevant government departments for aminimum period after receiving the training. All capacity that is developed will be linked to an explicit deliverable of the LDCF project, such as the production of maps or assessments, such that capacity-building exercises contribute directly to the implementation of the LDCF project.

162. Budget allocations for Operation and Maintenance of installed meteorological equipment is an important part of sustainability of the LDCF project interventions. This is particularly relevant to ZMD as there is uncertainty as to whether the minimum level of funding required for annual recurrent costs will be made available. Therefore the LDCF project will develop and implement promising innovative financing options for enhancing the long-term functionality and sustainability of the meteorological observation and forecasting systems. This will include identifying, developing and promoting public-private partnerships, innovative market-based financing mechanisms, institutional restructuring and cost recovery, i.e. developing one operation and maintenance unit under the ZMD.

163. Ultimately, the sustainability of the LDCF project will largely depend on the willingness of stakeholders to adopt interventions and continue to pursue them beyond the duration of the project. Suitable technical, legal and institutional capacity is necessary at both local and national level for sustainability to be achieved. This capacity will be strengthened by:

- improving institutional coordination within government;
- building awareness to climate change risks and the benefits of improved climate information and early warnings from local to national level;
- enhancing stakeholder capacity to use the climate information generated through the LDCF project; and
- developing an evidence base to stimulate greater levels of investments in climate information and early warning system projects, and to develop understanding of sector-specific needs and climate information priorities, as well as which policies and strategies are expected to provide economic growth benefits.

## 2.8. Replicability

164. The LDCF project will generate improved climate information at a national level, and activate communication channels and procedures for issuing early warnings at a national and local level. This will include the development of mobile-based alert platforms in Chipata, Gwembe and Sesheke Districts. There is thus considerable scope for replication of activities in the other districts of Zambia where related projects are not operational, using the improved climate information generated at a national level. To facilitate the effective replication of project activities, the lessons learned during the project implementation will be disseminated nationally through training programmes, the online platform and toolboxes including courses, handbooks and manuals.

165. The close involvement of government institutions and departments – principally DMMU and ZMD – in the LDCF project's development and implementation means that there is considerable potential for future incorporation of the project's approaches into on-going planning and strategies. Additionally, it is expected that the strengthening of capacities among key government stakeholders will enable continued mainstreaming of the use of climate information and early warnings into sectoral planning and decision-making.

166. Furthermore, the extensive training and capacity building of local communities and technical staff regarding the application of climate information and the response to early warnings will ensure that future local-level initiatives in Zambia are climate-aware and able to focus quickly on effective responses/information. As a result,LDCF project interventions are more likely to be replicated and/or upscaled to other districts in Zambia where similar benefits could be realised.

## 2.9 Stakeholder involvement plan

167. Stakeholder consultation has been a key feature in the design of this LDCF project, and stakeholders have been involved in identifying and prioritizing the LDCF project activities. Details of the stakeholder engagement during the design phase are provided in Section 2.2 and Annex 1 in the LDCF project document. On-going public consultation will critical for successful implementation of the project. This section outlines some of the key consultation principles and processes at a strategic level that will need to be translated into practical action during the project implementation. It provides guidance based on the initial stakeholder analysis, conducted as part of the project preparation process, and the consultations so far. This will be used to define exact activities that will form part of a communication and consultation strategy developed during the inception period of implementation.

Objectives

168. The stakeholder consultation during project implementation will be expected to support all outcomes. Overall, the objective of the consultation plan is to provide a framework to guide and promote two-way engagements between the Implementing Partner (ZMD), Responsible Parties (DMMU, DWA/WRMA, MAL, MoH, CSO and INCCS) and the key stakeholders with whom the project will engage and directly impact upon.

169. It is proposed that several more specific objectives for consultation are adopted:

- To ensure a general vision and understanding of the LDCF project and it's expected outcomes by all concerned stakeholders.
- To engage key stakeholders in planning, implementing and monitoring of specific interventions.
- To ensure consistent, supportive and effective communication (information, documentation, sharing, learning and feedback) processes with key implementing partners as well as the wider public including farmers and pastoralists.
- To influence and ensure strategic level support for project implementation from state and non-state organizations and international agencies through engagement in effective community, private sector and donor forums or platforms.

170. In delivering these objectives, there are a number of simple qualitative considerations that need to be taken into account when planning engagement processes and what they should be seeking to achieve:

- Identify constraints and solutions: As a two-way engagement, the consultation process should be used as an opportunity to identify with stakeholders possible constraints to or with the project's implementation and to work with the stakeholders in finding sustainable solutions.
- Managing expectations: The LDCF investment is relatively minor, compared to the adaptation demands facing Zambia. It will be important that consultations take due consideration to manage expectations of stakeholders and stakeholder groups.
- Partnerships for co-financing: The LDCF seek to add value to their investments by building on existing and parallel projects that represent co-financing and consultations should consider opportunities for partnerships that will leverage co-financing into innovative approaches or technologies that may improve efficiencies and enhance impact. Secured co-financing partners and amounts are detailed in Sections 2.4 and 4 of the LDCF project document.

Activities planned during implementation and evaluation

171. During implementation, the communication and consultation process will be divided into three main phases:

- Phase I – the mobilization phase in the first year of the project. The exact details of the activities and implementation structures will be designed, partnerships for action will be forged and stakeholder engagement will focus around these design processes.
- Phase II –the main implementation phase where investments will be made on the ground in the target areas and stakeholder consultation will focus on output-oriented action.
- Phase III –the completion of the LDCF project and the plans for scale-up and long-term sustainability of the LDCF investments. Consultation will focus on learning, bringing experience together and looking at processes for continued post-project impact.

Phase I – Developing a strategy and action plan

172. At mobilization, a simple communications strategy will be developed. Key principles to be considered in the development of the strategy include:

- An assessment of who the key stakeholders are. During the project design a stakeholder analysis was undertaken and key Responsible Parties were identified – during implementation this will be reviewed.
- The inclusion of women and children in line LDCF project, and the most appropriate means of engagement with these groups.
- The strategy should make as much use of existing mechanisms (institutions and processes) where possible, avoiding establishing new structures.

173. Types of consultation mechanism will include:

- an overarching multi-stakeholder group, i.e. the Project Board (Steering Committee), that will play governance role but also be a forum for stakeholder engagement;
- specific focus groups on technical interventions; and
- information briefings for government and co-financing institutions.

Phase II - Consultation through implementation

174. Once implementation begins, public consultations should become an ongoing exchange of information, with two main purposes for the various mechanisms outlined under Phase I:

- to gather information from beneficiaries and stakeholders about the impact and effectiveness of the planned adaptation packages (an efficient and reliable EWS) to support adaptive management – this will be achieved through surveys and consultations in Outputs 2.1 and 2.3; and
- to provide interested government and donor stakeholders and the general public with information about the progress and impact of the LDCF project as it is implemented – this will be achieved through the online platform established under Output 2.1.

Phase III - Project completion and scale up promotion

175. This will be a process of ensuring completion, hand-over and long-term sustainability of the LDCF investment. Consultation will focus on bringing experience together, sharing key lessons learnt (through the UNDP Adaptation Learning Mechanism and the online platforms established through Outcome 2 of the LDCF project) and looking at processes for promoting scale up of the LDCF project activities, particularly the application of activities in Output 2.3 in other vulnerable districts.

Stakeholders

176. The lead institution for project outputs will be ZMD for Outcome 1 and DMMU for Outcome 2. The outputs that the RPs and other groups will be key stakeholders in are shown in Table 9.

**Table 9.** Relevant partners and stakeholders identified for engagement by project outcome/output.

| Outcome | Output | Lead Institution | Key Partners | Key Responsibilities |
|---|---|---|---|---|
| **Outcome 1: Enhanced capacity of Zambia Meteorological Department to monitor and forecast extreme weather and climate change.** | **Output 1.1** 28 Automatic Weather Stations procured and installed, and 41 existing manual and automatic monitoring stations rehabilitated. | ZMD | DWA/WRMA, MAL and INCCS | Undertake systematic analysis.<br>Procure and install AWSs.<br>Undertake repairs.<br>Integrate AWSs into existing ZMD network. |
| | **Output 1.2** Weather and climate forecasting systems updated, including the installation of the required hardware and software and integration of satellite observations. | ZMD | DMMU, DWA/WRMA, MAL and INCCS | Upgrade ZMD's climate prediction model.<br>Upgrade and update the national ZMD database.<br>Review and install appropriate telecommunication infrastructure.<br>Procure and install forecasting workstations.<br>Develop and establish an online web platform.<br>Conduct training on the Satellite Distribution System. |
| | **Output 1.3** Capacity developed for operating and maintaining the climate observation network and related infrastructure including the training of 10 engineers, 10 technicians and local communities to maintain and repair meteorological equipment, computer infrastructure and telecommunications network. | ZMD | DWA/WRMA, MAL and INCCS | Develop an observation network quality control and maintenance toolbox.<br>Develop the capacity of 20 engineers.<br>Undertake an awareness campaign. |
| | **Output 1.4** Technical capacity of ZMD is developed to improve the production of standard and customized weather and climate forecasts and packaging meteorological | ZMD | DMMU, DWA/WRMA, MAL, UNZA and INCCS | Conduct training of i) 4 senior climatologists (based in Lusaka); ii) 20 analysts (2 in each province) and 28 weather forecasters.<br>Develop training |

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| | data and information into a suitable format for user agencies and local community end-users. | | | packages and toolkits. |
| **Outcome 2: Efficient and effective use of hydro-meteorological and environmental information for making early warnings and long-term development plans.** | **Output 2.1**Tailored, sector-specific weather and climate information made accessible to decision makers in government, private sector, civil society, development partners and local communities. | DMMU | ZMD, DWA/WRMA, MAL, MoH, CSO,INCCS and local communities in the priority districts of Chipata, Gwembe and Sesheke | Undertake a comprehensive assessment of existing centralised and decentralised early warning systems.<br>Develop and promote a weather and climate information online platform.<br>Train 3 personnel from each of DMMU, DWA/WRMA, MAL, MoH and CSO.<br>Develop and implement SOPs and information sharing/analysis agreements.<br>Evaluate the costs and benefits of accurate, timely and accessible weather and climate forecasts.<br>Build the human and technical capacity of the DMMU to facilitate inter-sectoral sharing of weather and climate information |
| | **Output 2.2**National capacity developed for assimilating weather and climate information into existing national policies, development plans and disaster management systems. | DMMU | ZMD, DWA/WRMA, MAL, MoH, CSO,INCCS, GRZ policy makers and local (district) government user agencies | Identify, review and propose revisions to sectoral policies, strategies, investment plans and annual workplans.<br>Develop and implement protocols for integrating weather and climate information into plans and selected policies.<br>Develop capacity to integrate weather and climate information into annual workplans.<br>Develop the capacity of local (district) government user agencies. |

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| | **Output 2.3** Communication channels and procedures for issuing warnings are enabled at a national level, and implemented at a district level through the development of mobile phone-based alert platforms in the priority districts of Chipata, Gwembe and Sesheke. | DMMU | ZMD, DWA/WRMA, MAL, MoH, CSO,INCCS and local communities in the priority districts of Chipata, Gwembe and Sesheke | Develop a communication and coordination strategy<br>Develop an early warning system dissemination national and local toolbox.<br>Undertake field visits and stakeholder consultations.<br>Map sub-basin climate hazards.<br>Establish an Open Data Platform<br>Implement a two-way, SMS-based alert system. |
| | **Output 2.4** Public-private partnership developed for sustainable financing of the operation and maintenance of the installed meteorological observation network. | DMMU | ZMD (Instruments Division), MAL, CSO, INCCS andprivatesector companies | Undertake a review of the agriculture insurance sector.<br>Develop Terms of Reference and issue a call for proposals.<br>Establish the public-private partnership. |

## 3. PROJECT RESULTS FRAMEWORK

| | | | | | |
|---|---|---|---|---|---|
| **This project will contribute to achieving the following Country Programme Outcome as defined in CPAP or CPD:** 2.1) Government and partners enable vulnerable populations to be food secure by 2015; 4.1) Disaster Management and Mitigation Unit (DMMU) has a fully functional national disaster management and early warning system to prevent, alert and respond to disasters by 2015; 4.2) Government promotes adaptation and provide mitigation measures to protect livelihoods from climate change by 2015; and 4.3) Government implements policies and legal frameworks for sustainable community based natural resources management by 2015. | | | | | |
| **Country Programme Outcome Indicators:** 2.1) Proportion of population below minimum level of dietary energy consumption (%); 4.1) % of disasters with timely responses; 4.2) Number of households benefiting from environment and Climate Change adaptation and mitigation funds; and 4.3) % reduction in annual average deforestation rate. | | | | | |
| **Primary applicable Key Environment and Sustainable Development Key Result Area:** Promote climate change adaptation | | | | | |
| **Applicable SOF (e.g. GEF) Strategic Objective and Program:** Objective 2 "Increase adaptive capacity to respond to the impacts of climate change, including variability, at local, national, regional and global level". | | | | | |
| **Applicable SOF (e.g. GEF) Expected Outcomes:** Outcome 2.1 "Increased knowledge and understanding of climate variability and change-induced risks at country level and in targeted vulnerable areas"; and Outcome 2.2 "Strengthened adaptive capacity to reduce risks to climate-induced economic losses". | | | | | |
| **Applicable SOF (e.g. GEF) Outcome Indicators:**<br>• Relevant risk information disseminated to stakeholders<br>• Type and no. monitoring systems in place<br>• % of population covered by climate change risk measures | | | | | |
| | **Indicator** | **Baseline** | **Targets End of Project** | **Source of verification** | **Risks and Assumptions** |
| **Project Objective:** To strengthen the climate monitoring capabilities, early warning systems and available information for responding to climate shocks and planning adaptation to climate change in Zambia. | 1. Capacity as per capacity assessment scorecard.<br><br>2. Domestic finance committed to ZMD and DMU to monitor and warn against extreme weather and climate change. | 1. Average capacity scorecard rating of **80** across men and women (see Annex 5).<br><br>2. Annual budget of: **US$ 322,680** allocated to ZMD; and **US$ 614,057** allocated to DMMU. | 1. Capacity scorecard rating is increased to an average of **171** for both men and women (see Annex 5).<br><br>2. **20% increase**32 in annual domestic finance allocated to ZMD and DMMU to monitor and warn against extreme weather and climate change. | 1. Focus group interviews with climate information and EWS-related stakeholders; consultant reports.<br><br>2. Review of ZMD and DMMU annual budgets. | Risk: Human, technical capacity within DMMU, ZMD, MAL, DWA/WRMA, MoH and CSO, including extension services and within decentralised offices, is insufficient to effectively implement the LDCF project.<br>Assumption: Training opportunities provided through the LDCF project result in the development of the required capacity, and the government provides the necessary budget to provide the required institutional framework in which the newly skilled staff can operate.<br><br>Risk: Poor coordination and information sharing structures/agreements between IP (ZMD), RPs (DMMU, MAL, DWA/WRMA, MoH and CSO) and UNDP CO results in institutional failure, compartmentalized progress and delayed implementation of the LDCF project.<br>Assumption: The management arrangements established through the LDCF project result in a |

[32]To be confirmed during project inception.

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| | | | | | coordinated approach to implementing the project.<br><br>Risk: Insufficient institutional support and political commitments from the government leads to a decrease in the political will ensured during project design, ultimately destabilizing the LDCF project.<br>Assumption: Government commitment established during the design phase of the LDCF project is maintained for the project duration.<br><br>Risk: The slow pace of policy modification may mean that identified development frameworks do not integrate climate change in a timely fashion<br>Assumption: Climate change adaptation considerations are included in development framework formulation, based on advancements in climate information and forecasting achieved through the LDCF project. |
| **Outcome 1: Enhanced capacity of Zambia Meteorological Department to monitor and forecast extreme weather and climate change.** | 1. Percentage of national coverage of climate monitoring network (fully operational[33]).<br><br>2. Frequency data transmission and reception. | 1. Automatic: **0%** of districts; Manual: **0%** of districts[34].<br><br>2. At present, the 2 AWSs transmit data which is sent daily<br><br>Majority of manual stations record data at (GMT) **06h00, 09h00, 12h00,** | 1. Automatic: **29%** of districts; Manual **37%** of districts[35].<br><br>2. 30 AWSs (28 new, 2 rehabilitated), transmitting continuously<br><br>39 rehabilitated manual stations collecting data at the **synoptic hours** of (GMT) 06h00, 09h00, 12h00, 15h00, 18h00 | 1. Field inspection of AWS sites; review of climate information database.<br><br>2. Review of climate information database. | Risk: Delayed implementation of baseline projects by the government and donors negatively affects LDCF project outcomes.<br>Assumption: Baseline projects are implemented according to the timeline identified in the PPG phase of the LDCF project, and achieve the desired outcomes and objective.<br><br>Risk: Installed hydro-meteorological equipment fails because it is vandalised or not maintained.<br>Assumption: Communities living nearby installed hydro-meteorological equipment commit to taking active measures to prevent the equipment from being vandalised; and the equipment is adequately maintained by the responsible institution.<br><br>Risk: Climate shocks occurring during the design and implementation phase of the LDCF project result in disruptions to installed equipment and severely affect communities, prior to the EWSs being established.<br>Assumption: Any climate shocks occurring whilst |

[33]This is interpreted as all sensors and equipment functioning as intended, including the communication/data transfer system, if installed.
[34]At present, there are only 2 AWSs and 39 manual stations across the 105 districts – however, all of these are in need of rehabilitation (extent required to be determined through Output 1.1).
[35]AWSs will be installed in 30 (28 new, 2 rehabilitated) out of 105 districts and will be fully operational; manual stations will be rehabilitated in 39 of the 105 districts and will be fully operational.

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| | | **15h00.** However, provision to ZMD **does not occur daily**. | and 00h00, and sending to ZMD **daily**. | | the EWSs are being established will not be so severe as to result in a relocation of the communities where the effectiveness of the EWSs will be tested.<br><br>Risk: Local information technology and telecommunications infrastructure restricts the transfer of data from installed equipment to necessary recipients, and restricts communication amongst key role players and end-users.<br>Assumption: Information technologies and telecommunications systems implemented or used, where such suitable system already exists, through the LDCF project are best suited to the local context and do not restrict the transfer and communication of information.<br><br>Risk: Procurement and installation of hydro-meteorological equipment, including hardware and software, is delayed because of complications with the release of funds and/or national procurement procedures.<br>Assumption: UNDP CO and HQ will coordinate with the IP to ensure effective administrative planning meaning the equipment is procured and installed in a timely manner. |
| **Outcome 2**<br>**Efficient and effective use of hydro-meteorological and environmental information for making early warnings and long-term development plans.** | 1. Percentage of population in Chipata, Gwembe and Sesheke Districts with access to improved climate-related flood and drought warnings (disaggregated by gender).<br><br>2. Development frameworks and disaster policies that integrate | 1. **0%** of men<br>**0 %** of women.<br><br>2. The **Sixth National Development Plan** highlights | 1. **100 %** of men;<br>**100 %** of women.<br><br>2. At least the **Seventh National Development Plan** to incorporate the availability of climate | 1. Gender-sensitive field surveys undertaken within identified priority sites, representative the Zambia population; consultant reports<br><br>2. Review of Seventh National Development Plan. | Risk: Lack of commitment from communities where EWS are established undermines the effectiveness of the LDCF project demonstrations.<br>Assumption: Awareness raising activities, and the demonstration of the advantages of responding to the information provided through the established EWS, will ensure the commitment of the communities in participating in the LDCF project.<br><br>Risk: Poor coordination and information sharing structures/agreements between IP (ZMD), RPs (DMMU, MAL, DWA/WRMA, MoH and CSO) and UNDP CO results in institutional failure, compartmentalized progress and delayed implementation of the LDCF project.<br>Assumption: The management arrangements established through the LDCF project result in a coordinated approach to implementing the project. |

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| | climate information in the formulation. | the need to develop climate change mainstreaming and response strategies, but not the need for improved information to inform the strategies. | information into planning for the five year period. | | Risk: Human, technical capacity within DMMU, ZMD, MAL, DWA/WRMA, MoH and CSO, including extension services and within decentralised offices, is insufficient to effectively implement the LDCF project.<br>Assumption: Training opportunities provided through the LDCF project result in the development of the required capacity, and the government provides the necessary budget to provide the required institutional framework in which the newly skilled staff can operate. |
| | 3. Sector-specific, tailored climate information packages that integrate climate risks. | 3. ZMD, in collaboration with the relevant line ministries, produces sector-specific forecasts for **agriculture, aviation, water and health**. | 3. Sector-specific, tailored climate information packages produced for **agriculture, aviation, water, health[36], tourism, construction, road and rail transport, and energy**. | 3. Interviews with line ministries and a review of the information packages released. | Risk: Insufficient institutional support and political commitments from the government leads to a decrease in the political will ensured during project design, ultimately destabilizing the LDCF project.<br>Assumption: Government commitment established during the design phase of the LDCF project is maintained for the project duration.<br><br>Risk: The slow pace of policy modification may mean that identified development frameworks do not integrate climate change in a timely fashion<br>Assumption: Climate change adaptation considerations are included in development framework formulation, based on advancements in climate information and forecasting achieved through the LDCF project. |

[36] Forecasts for agriculture, aviation, water and health are already being produced, but the indicator stresses the use of "improved climate information".

## 4. TOTAL BUDGET AND WORKPLAN

| | | | |
|---|---|---|---|
| **Award ID:** | 00074216 | Project ID(s): | 00086729 |
| **Award Title:** | Strengthening climate information and early warning systems | | |
| **Business Unit:** | ZMB10 | | |
| **Project Title:** | Strengthening climate information and early warning systems in Eastern and Southern Africa for climate resilient development and adaptation to climate change – Zambia | | |
| **PIMS no.** | 5091 | | |
| **Implementing Partner (Executing Agency)** | Ministry of Transport, Works, Supply and Communication (Zambia Meteorological Department) | | |

| SOF (e.g. GEF) Outcome/Atlas Activity | Responsible Party/ Implementing Agent | Fund ID | Donor Name | Atlas Budgetary Account Code | ATLAS Budget Description | Amount Year 1 (US$) | Amount Year 2 (US$) | Amount Year 3 (US$) | Amount Year 4 (US$) | Total (US$) | See Budget Note: |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **OUTCOME 1:** | **Zambia Meteorological Department** | **62160** | **GEF LDCF** | 71300 | Local Consultants | 47,000 | 22,250 | 14,000 | 4,000 | 87,250 | a |
| | | | | 71400 | Contractual services | 0,00 | 24,000 | 24,000 | 15,500 | 63,500 | b |
| | | | | 72300 | Materials and Goods | 178,000 | 782,500 | 409,000 | 4,000 | 1,373,500 | c |
| | | | | 74200 | Audio Visual & Print Prod Costs | 102,000 | 61,000 | 35,000 | 19,000 | 217,000 | d |
| | | | | 75700 | Training, Workshops and Conferences | 388,250 | 9,500 | 8,500 | 8,500 | 414,750 | e |
| | | | | 71300 | Local Consultants | 32,000 | 32,000 | 32,000 | 32,000 | 128,000 | f |
| | | | | | **Total Outcome 1** | **747,250** | **931,250** | **522,500** | **83,000** | **2,284,000** | |
| **OUTCOME 2:** | **Disaster Management and Mitigation Unit** | **62160** | **GEF LDCF** | 71300 | Local Consultants | 11,250 | 52,500 | 34,000 | 27,750 | 125,500 | g |
| | | | | 71400 | Contractual services | 0,00 | 24,000 | 14,000 | 15,500 | 53,500 | h |
| | | | | 72300 | Materials and Goods | 72,500 | 139,000 | 64,632 | 10,000 | 286,132 | i |
| | | | | 74200 | Audio Visual & Print Prod Costs | 11,368 | 210,000 | 67,500 | 58,500 | 347,368 | j |
| | | | | 75700 | Training, Workshops and Conferences | 5,000 | 56,000 | 68,500 | 66,000 | 195,500 | k |
| | | | | 71300 | Local Consultants | 32,000 | 32,000 | 32,000 | 32,000 | 128,000 | l |
| | | | | | **Total Outcome 2** | **132,118** | **513,500** | **280,632** | **209,750** | **1,136,000** | |
| **PROJECT MANAGEMENT COSTS/UNIT** | **Zambia Meteorological Department** | **62160** | **GEF LDCF** | 74500 | UNDP cost recovery chrgs-Bills | 5,873 | 4,731 | 3,353 | 2,911 | 16,868 | m |
| | | | | 71300 | Local Consultants | 22,132 | 27,000 | 27,000 | 27,000 | 103,132 | n |
| | | | | 71600 | Travel | 7,500 | 7,500 | 7,500 | 7,500 | 30,000 | o |
| | | | | 74500 | Miscellaneous | 10,000 | 10,000 | 10,000 | 10,000 | 40,000 | p |
| | | | | | **Total Project Management Costs** | **35,505** | **49,231** | **47,853** | **47,411** | **180,000** | |
| | | | | | **PROJECT TOTAL** | **924,873** | **1,493,981** | **840,985** | **340,161** | **3,600,000** | |

**Summary of funds:**

| | Amount Year 1 | Amount Year 2 | Amount Year 3 | Amount Year 4 | Total |
|---|---|---|---|---|---|
| **LDCF** | 924,873 | 1,493,981 | 840,985 | 340,161 | **3,600,000** |
| **GRZ** | 936,737 | 936,737 | 936,737 | 936,736 | **3,746,947** |
| **SASSCAL** | 261,667 | 261,667 | 261,666 | 0 | **785,000** |
| **WB** | 2,000,000 | 2,000,000 | 2,000,000 | 2,000,000 | **8,000,000** |
| **UNDP** | 300,000 | 300,000 | 200,000 | 200,000 | **1,000,000** |
| **TOTAL** | **4,546,277** | **5,177,385** | **4,274,388** | **3,533,897** | **17,131,947** |

**Budget notes:**

| | |
|---|---|
| a | National meteorological specialist (30 days @ $250/day)<br>National meteorological specialist (25 days @ $250/day),<br>National hydrological specialist (20 days @ $250/day),<br>National Communications and ICT specialist (40 days @ $250/day)<br>National community development / meteorological specialist (60 days @ $250/day)<br>National meteorological specialist (20 days @ $250/day)<br>National meteorological specialist (20 days @ $250/day)<br>National communication and ICT specialist (20 days @ $250/day)<br>National meteorological specialist (20 days @ $250/day)<br>National communication and ICT specialist (10 days @ $250/day)<br>National meteorological specialist (20 days @ $250/day) |
| b | International M&E expert (13 days @ $550/day; 1 flight @ $2000; 5 DSA @ 200/day)<br>Independent Mid-term evaluation (@ $15000/ea), Independent Terminal evaluation (@ $22500/ea), and 4 Project audits. |
| c | 28 AWSs for priority districts (@ $15000/AWS)<br>28 Installation and civil works including stabilizing power supply with solar panels, batteries, inverters and including security fence for AWSs (@ $6000/ea)<br>39 Upgrade manual stations - including thermometers, stevenson screens, manual wind and solar sensors with digital sensors and calibrate thermometers and barometers (@ $4500/ea)<br>2 Upgrade AWSs - replace units (@ $5000/ea)<br>41 Installation and civil works including stabilizing power supply with solar panels, batteries and inverters (AWSs), upgrading weather fences (manual stations) (@ $5000/ea)<br>39 Calibration and installation costs for upgrades including fieldtrips to sites (@ $5000/ea)<br>30 Modern forecasting workstations (hardware and software) to support ZMD synoptic stations including internet modems and access (@ $5000/ea)<br>Installation of SADIS (@ $50000/ea)<br>Cost of facilitation of tasks required by technical hydro-meteorological staff and disaster management offices for ensuring the effective operation and maintenance of all equipment installed |
| d | Cost of developing, hosting and maintaining a climate prediction model (@ $50000/ea)<br>Cost of developing, hosting and maintaining an integrated hydro-meteorological database and information management system (@$100000/ea)<br>Cost of developing, hosting and maintaining a telecommunications system with GTS access (@$64000/ea)<br>Cost of editing, printing and publishing protocols, handbooks, policy and information briefs and/or guidelines on climate change adaptation, hydro-meteorological and early warning systems |

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| | Cost of editing, printing and publishing brochures, pamphlets, handbooks and/or guidelines on climate change adaptation, hydro-meteorological and early warning systems<br>Cost of editing, printing and publishing protocols, handbooks, policy and information briefs and/or guidelines on climate change adaptation, hydro-meteorological and early warning systems |
| e | Cost of developing and promoting 'toolboxes', protocols, handbooks, policy and information briefs and/or guidelines on climate change adaptation, hydro-meteorological and early warning systems<br>Cost of training for in-country national meteorological operation and maintenance (3 x 2 weeks)<br>Cost of training for in-country national telecommunications and ICT operation and maintenance (3 x 2 weeks)<br>Cost of training for 4 senior climatologists (based in Lusaka); ii) 20 analysts (2 in each province); 28 weather forecasters (1 per AWS installed); and 3 researchers based at UNZA on state-of-the-art region-specific weather and climate forecasting and in-house capacity building<br>Cost of developing training packages and toolkits for assisting trained meteorologists and hydrologists build in-house forecasting and capacity and enhance collaboration in the ZMD and relevant line ministries<br>Cost of two scholarships for post graduate degrees in climatology and climate modelling<br>Cost of Inception Workshop to launch project |
| f | Local consultants support for organising and conducting equipment surveys/reports, identifying and liaising on procurement of equipment with line ministries and facilitating NHMS etc. training programs. |
| g | National adaptation, early warning system and disaster management consultant (15 days @ $250/day)<br>National climate change modeller/risk and vulnerability assessment and mapping (10 days @ $250/day), National Communications and ICT specialist (10 days @ $250/day), National Agricultural expert (10 days @ $250/day), National Health expert (5 days @ $250/day)<br>National climate change modeller/risk and vulnerability assessment and mapping (5 days @ $250/day), National Communications and ICT specialist (5 days @ $250/day), National Agricultural expert (5 days @ $250/day), National Health expert (3 days @ $250/day), National Hydrology expert (5 days @ $250/day)<br>National social and natural resource economist (30 days @ $250/day)<br>National institutional development and coordination specialist (5 days @ $250/day), National hydro-meteorological operation and maintenance technical and factory training expert (5 days @ $250/day), National Communication and ITC specialist (5 days @ $250/day)<br>National policy and strategy advisor (30 days @ $250/day)<br>National policy and strategy advisor (10 days @ $250/day), National adaptation, early warning system and disaster management consultant (10 days @ $250/day)<br>National policy and strategy advisor (18 days @ $250/day)<br>National policy and strategy advisor (15 days @ $250/day)<br>National adaptation, early warning system and disaster management consultant (20 days @ $250/day)<br>National adaptation, early warning system and disaster management consultant (15 days @ $250/day)<br>National social and natural resource economist (20 days @ $250/day)<br>National GIS hazard mapping specialist (60 days @ $250/day)<br>National communication and ICT specialist (15 days @ $250/day)<br>National adaptation, early warning system and disaster management consultant (15 days @ $250/day)<br>National agriculture insurance consultant (20 days @ $250/day)<br>National public-private sector relations consultant (10 days @ $250/day)<br>National agriculture insurance consultant (60 days @ $250/day)<br>(436 days @ 250/day + contingencies) |
| h | International M&E expert (13 days @ $550/day; 1 flight @ $2000; 5 DSA @ 200/day)<br>Independent Mid-term evaluation (@ $15000/ea), Independent Terminal evaluation (@ $22500/ea), 2 Budget/Project audits |
| i | Cost of developing sector-specific vulnerability maps and tailored weather and climate alerts.<br>Cost of developing a vulnerability hazard database (@$80500/ea)<br>Cost of develop a national weather and climate information and early warning system communication and coordination strategy<br>Cost of developing GIS hazard maps for Chipata, Gwembe and Sesheke Districts (@$20000/ea)<br>Cost of facilitation of tasks required by technical hydro-meteorological staff and disaster management offices for field visits and other project activities related to ensuring the effective operation and maintenance of all equipment installed. |

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| | Cost of developing sector-specific vulnerability maps and tailored weather and climate alerts. |
| j | Cost of developing, implementing and maintaining coordination protocols and agreements<br>Cost of editing, printing and publishing protocols, handbooks, policy and information briefs and/or guidelines on climate change adaptation, hydro-meteorological and early warning systems<br>Cost of editing, printing and publishing protocols, handbooks, policy and information briefs and/or guidelines on climate change adaptation, hydro-meteorological and early warning systems<br>Cost of developing and implementing protocols for integrating weather and climate information into disaster policy and downscaling in the Chipata, Gwembe and Sesheke Districts<br>Cost of developing, hosting and maintaining an Open Data Platform in Chipata, Gwembe and Sesheke Districts (@$20000/ea)<br>Cost of developing, hosting and maintaining a two-way, SMS based alert system in Chipata, Gwembe and Sesheke Districts (@$259500)<br>Cost of reporting costs, communications (telephone and internet) and transport facilitation |
| k | Cost of training for line ministries in tailoring climate information to produce sector specific warnings.<br>Cost of developing and promoting 'toolboxes', protocols, handbooks, policy and information briefs and/or guidelines on climate change adaptation, hydro-meteorological and early warning systems<br>Cost of developing and promoting 'toolboxes', protocols, handbooks, policy and information briefs and/or guidelines on climate change adaptation, hydro-meteorological and early warning systems<br>Cost of training for national early warning committee<br>Cost of developing and promoting 'toolboxes', protocols, handbooks, policy and information briefs and/or guidelines on climate change adaptation, hydro-meteorological and early warning systems<br>Cost of training for relevant ministries/departments/agencies to integrate weather and climate information into annual workplans.<br>Cost of training for district-level committees in the Chipata, Gwembe and Sesheke Districts to integrate weather and climate information into development plans at a district and/or sub-country level<br>Cost of developing and promoting 'toolboxes', protocols, handbooks, policy and information briefs and/or guidelines on climate change adaptation, hydro-meteorological and early warning systems<br>Cost of training for GIS analysis and risk mapping specialists in key ministries<br>Cost of training for meteorological officer on private sector training and awareness raising on value of climate information to private sector<br>Cost of Inception Workshop to launch project |
| l | Local consultants costs to monitor the utility of forecasts/predictions for end-users and the efficacy of the Standard Operation Procedure for alert communication. Organise workshops, meetings and feedback sessions from users of forecasts and SOPs |
| m | Cost of UNDP County Office support services including: i) identification and recruitment of project personnel, international and local consultants; ii) identification and facilitation of training activities abroad; and iii) procurement of equipment, computers and furniture. For more details see Annex 3.8. |
| n | Cost of Project Driver<br>Cost of national level Project Manager located within ZMD<br>Cost of Financial/Administrative Officer located within ZMD |
| o | Cost of Project Manager travel, project team travel and local transport around regions and districts |
| p | Miscellaneous Expenses and contingency |

**Annual Work Plan:**

| Outcome | Output | 2013 | | | | 2014 | | | | 2015 | | | | 2016 | | | | 2017 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Enhanced capacity of Zambia Meteorological Department to monitor and forecast extreme weather and climate change.** | 28 Automatic Weather Stations procured and installed, and 41 existing manual and automatic monitoring stations rehabilitated. | | | | | | | | | | | | | | | | | | | | |
| | Weather and climate forecasting systems updated, including the installation of the required hardware and software and integration of satellite observations. | | | | | | | | | | | | | | | | | | | | |
| | Capacity developed for operating and maintaining the climate observation network and related infrastructure including the training of 10 engineers, 10 technicians and local communities to maintain and repair meteorological equipment, computer infrastructure and telecommunications network. | | | | | | | | | | | | | | | | | | | | |
| | Technical capacity of ZMD is developed to improve the production of standard and customized weather and climate forecasts and packaging meteorological data and information into a suitable format for user agencies and local community end-users. | | | | | | | | | | | | | | | | | | | | |
| **Efficient and effective use of hydro-meteorological and environmental information for making early warnings and long-term development plans.** | Tailored, sector-specific weather and climate information made accessible to decision makers in government, private sector, civil society, development partners and local communities. | | | | | | | | | | | | | | | | | | | | |
| | National capacity developed for assimilating weather and climate information into existing national policies, development plans and disaster management systems. | | | | | | | | | | | | | | | | | | | | |
| | Communication channels and procedures for issuing warnings are enabled at a national level, and implemented at a district level through the development of mobile phone-based alert platforms in the priority districts of Chipata, Gwembe and Sesheke. | | | | | | | | | | | | | | | | | | | | |
| | Public-private partnership developed for sustainable financing of the operation and maintenance of the installed meteorological observation network. | | | | | | | | | | | | | | | | | | | | |

## 5. MANAGEMENT ARRANGEMENTS

177. The LDCF project will be implemented over a four year period. ZMD will function as the Implementing Partner (IP) for this project[37]. ZMD, as the IP, will be responsible and held accountable for managing the LDCF project on a day-to-day basis as per UNDP's NIM policies and procedures. The identification and stakeholder endorsement of ZMD[38]as the IP is based on their functional, operational and technical abilities including current mandate, including to *inter alia:* i) establish and maintain a network of surface and upper air stations for the purpose of observing various weather elements; ii) process and analyse meteorological data for use in the planning of economic development and for rational exploitation of natural resources; iii) provide meteorological information service to government departments, public corporations and the general public; iv) provide meteorological services for the development of agriculture, water resources and other weather-sensitive economic sectors; and v) conduct research in meteorology and to co-operate with organisations concerned with meteorological research and applications. Prior to implementation, a review of the capacity assessment undertaken for the IP (Annex 6) will be conducted and measures put in place to ensure the project is implemented in full alignment with UNDP policies and procedures. The management arrangements are shown in Figure 5 and detailed further below.

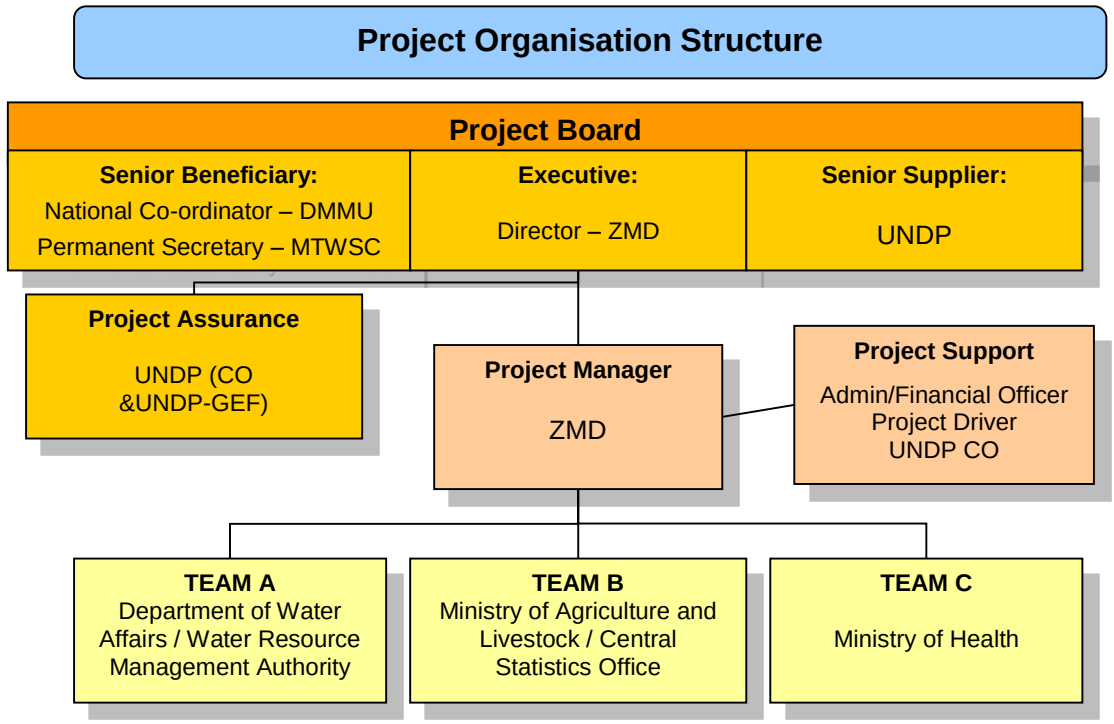


**Figure 5:** Management arrangements for the LDCF project.

178. The **Project Board** (also called the **Project Steering Committee**) will be responsible for making the management decisions of the LDCF project, and will guide the Project Manager. The Project Board plays a critical role in monitoring progress of implementation and ensuring that recommendations from annual and mid-term evaluations are adopted for performance improvement, ensuring accountability and adoption of lessons learnt. It ensures that required resources are committed and arbitrates on any conflicts within the project or negotiates a solution to any problems

[37] Capacity assessments (macro-level) of DMMU and ZMD were undertaken and endorsed by UNDP CO. See Annex 6 for the results of the capacity assessment.
[38]See Annex 3.1 for a Letter of Agreement from DMMU endorsing ZMD as the IP for the project.

with external bodies. In addition, it approves the appointment and responsibilities of the Project Manager. Based on the approved Annual Work Plan, the Project Board will be kept informed of progress with the implementation of quarterly plans and also approve any essential deviations from the original plans.

179. Potential members of the Project Board are reviewed and recommended for approval during the PAC meeting. Representatives of other stakeholders can be included in the Project Board as appropriate. The Project Board contains three distinct roles, including:

- **An Executive** representing the project ownership to chair the group. The Executive for the LDCF project will be the Director of ZMD.
- **Senior Supplier** representing the interests of the parties concerned which provide funding for specific cost sharing projects and/or technical expertise to the project. The Senior Supplier's primary function within the Board is to provide guidance regarding the technical feasibility of the project. The Senior Supplier of the LDCF project is UNDP. In order to ensure UNDP's ultimate accountability for the project results, Project Board decisions will be made in accordance to standards that shall ensure management for development results, best value for money, fairness, integrity, transparency and effective international competition. In cases where consensus cannot be reached within the Project Board, the final decision shall rest with UNDP in its role as the Senior Supplier.
- **Senior Beneficiaries** representing the interests of those who will ultimately benefit from the project, i.e. sector and communities vulnerable to the impacts of climate change. The Senior Beneficiaries' primary function within the Board is to ensure the realization of project results from the perspective of project beneficiaries. The Senior Beneficiaries for the LDCF project will be the National Co-ordinator (Permanent Secretary) of DMMU and the Permanent Secretary of the Ministry of Transport, Works, Supply and Communication (MTWSC).

180. The Project Board will be supported by the following roles:

- The **Project Assurance** role supports the Project Board Executive by carrying out objective and independent project oversight and monitoring functions. UNDP-GEF and the UNDP Zambia CO will provide Project Assurance to the Project Board for the LDCF project.
- The **Project Manager** has the authority to run the project on a day-to-day basis within the constraints laid down by the Project Board. The Project Manager's prime responsibility is to ensure that the project produces the results specified in the Project Document, to the required standard of quality and within the specified constraints of time and cost. The Project Manager will be selected by ZMD, the Implementing Partner, in consultation with UNDP CO. The Project Manager will be based within ZMD.
- The **Project Support** role provides project administration, management and technical support to the Project Manager. Project Support will be provided by an Administrative/Financial Assistant and Project Driver recruited through the LDCF project. The UNDP CO will provide further Project Support through a set of support services for the activities of the project (see UNDP Support Services, below). Additionally, UNDP is providing US$ 400,000 as cash co-financing. This funding will be used to assist with project coordination by the UNDP CO, including a "Liaison "Officer" to assist ZMD with Implementing Partner role.

181. The Project Manager will be supported by teams of Responsible Parties, including DMMU, DWA/WRMA and MAL/CSO. Further RPs include MoH and INCCS. The RPs and key responsibilities are shown per output in Table 7, Section 2.9. The IP and RPs played a substantial role in designing the activities for the LDCF project and were involved in the consultations described in "Stakeholder baseline analysis" in Section 2.2.

182. The management structure will seek to establish a bridge between: i) national authorities responsible for formulating and integrating climate change policies; ii) national, regional and local authorities responsible for project implementation; and iii) on-the-ground practitioners of climate information management and disaster risk reduction. Continuous monitoring of project progress at all levels will ensure the project activities are always aligned with project goals.

183. As per discussions with the GEF Secretariat, this initiative is part of a multi-country set of NIM projects supported by UNDP-GEF. In response to LDCF/SCCF Council requirement that a regional component would be included to enhance coordination, increase cost effectiveness and, most importantly, benefit from a regional network of technologies, a cohort of technical advisors and a project manager will be recruited to support each of the national level project teams. In particular they will support countries to develop robust adaptation plans and provide technical advice, training and support for accessing, processing and disseminating data for early warning and national/sectoral planning related purposes on a systematic basis. The cost of these project staff has been prorated across all country project budgets and recruitment of these posts will be undertaken by UNDP-GEF (HQ) in coordination with all UNDP Country Offices.

*Audit arrangements*

184. Audits will be conducted in accordance with UNDP financial rules and regulations and applicable audit policies.

*UNDP Support Services*

185. UNDP has been requested by GRZ (ZMD) to provide the following support services for the activities of the project:

- identification and recruitment of project personnel, International and Local Consultants;
- identification and facilitation of training activities abroad; and
- procurement of equipment, computers and furniture (in general procurement will be done using national procurement systems and procedures where possible as long as key principles of competitiveness, accountability and transparency are followed).

186. ZMD, as the IP, will be responsible for the following activities in relation to the support services provided by the UNDP CO:

- annual preparation of a procurement plan based on the annual work plan and submit it with the request for project support implementation services; and
- once the services have been rendered, preparation of one consolidated request direct for payment to UNDP as per schedule in the LOA in Annex 3.7.

187. UNDP CO will undertake the following activities:

- upon receipt the request for support services and the procurement plan, UNDP CO will verify it against the workplan and, if in line with the annual workplan and the available budget, will commence the procurement;
- once procurement has been completed, UNDP CO will inform ZMD accordingly and submit verified copies of the transaction for record and auditing purpose; and
- on 1st December every year UNDP will bill ZMD of the services rendered.

188. The above are considered services, which are beyond UNDP's role as a GEF IA. Direct Project Costs (DPCs) are costs incurred by UNDP when providing Direct Project Services (DPS).In accordance with UNDP policies and GEF Council requirements, the cost of any anticipated DPS to be incurred by UNDP need to be clearly identified and estimated in the Project Document. The costs should be calculated on the basis of estimated actual costs or transaction-based costs, using the UPL (for standard service transactions) or Local Price List template (for non-standard service transactions), as a reference point.

189. In the case of this LDCF project, Direct Project Costs have been estimated and are transparently outlined in the project budget. A LOA documenting the agreed DPS and DPC is annexed at Annex 3.7.

## 6. MONITORING FRAMEWORK AND EVALUATION

190. The project will be monitored through the following M& E activities. The M&E budget is provided in the table below. The M&E framework set out in the Project Results Framework in Part III of this project document is aligned with the AMAT and UNDP M&E frameworks.

191. **Project start**: A Project Inception Workshop will be held within the first 2 months of project start with those with assigned roles in the project organization structure, UNDP country office and where appropriate/feasible regional technical policy and program advisors as well as other stakeholders. The Inception Workshop is crucial to building ownership for the project results and to plan the first year annual work plan.

192. The **Inception Workshop** should address a number of key issues including:

- Assist all partners to fully understand and take ownership of the project. Detail the roles, support services and complementary responsibilities of UNDP CO and RCU staff *vis-à-vis* the project team. Discuss the roles, functions, and responsibilities within the project's decision-making structures, including reporting and communication lines, and conflict resolution mechanisms. The Terms of Reference for project staff will be discussed again as needed.
- Finalise the first annual work plan based on the project results framework and the LDCF-related AMAT set out in the Project Results Framework in Section III of this project document. Review and agree on the indicators, targets and their means of verification, and re-check assumptions and risks.
- Provide a detailed overview of reporting, monitoring and evaluation (M&E) requirements. The Monitoring and Evaluation work plan and budget should be agreed and scheduled.
- Discuss financial reporting procedures and obligations and arrangements for annual audit.
- Plan and schedule PB meetings. Roles and responsibilities of all project organisation structures should be clarified and meetings planned. The first PB meeting should be held within the first 12 months following the inception workshop.

193. An **Inception Workshop report** is a key reference document and must be prepared and shared with participants to formalize various agreements and plans decided during the meeting.

194. Quarterly:

- Progress made shall be monitored in the UNDP Enhanced Results Based Management Platform.
- Based on the initial risk analysis submitted, the risk log shall be regularly updated in ATLAS. Risks become critical when the impact and probability are high. Note that for UNDP/GEF projects, all financial risks associated with financial instruments such as revolving funds, microfinance schemes, or capitalization of ESCOs are automatically classified as critical on the basis of their innovative nature (high impact and uncertainty due to no previous experience justifies classification as critical).
- Based on the information recorded in Atlas, a Project Progress Reports (PPR) can be generated in the Executive Snapshot.
- Other ATLAS logs will be used to monitor issues and lessons learned. The use of these functions is a key indicator in the UNDP Executive Balanced Scorecard.

195. **Annually**: Annual Project Review/Project Implementation Reports (APR/PIR).This key report is prepared to monitor progress made since project start and in particular for the previous reporting period (30 June to 1 July). The APR/PIR combines both UNDP and GEF reporting requirements.

196. The APR/PIR includes, but is not limited to, reporting on the following:

- Progress made toward project objective and project outcomes , including indicators, baseline data and end-of-project targets (cumulative);

- Project outputs delivered per project outcome (annual);
- Lesson learned/good practice;
- AWP and other expenditure reports;
- Risk and adaptive management; and
- ATLAS QPR.

197. **Periodic Monitoring** through site visits: UNDP CO and the UNDP-GEF region-based staff will conduct visits to project sites based on the agreed schedule in the project's Inception Report/Annual Work Plan to assess first hand project progress. Other members of the Project Board may also join these visits. A Field Visit Report/BTOR will be prepared by the CO and UNDP RCU and will be circulated to the project team and Project Board members no morethan one month after the visit.

198. **Mid-term of project cycle**: The project will undergo an independent Mid-Term Review at the mid-point of project implementation. The Mid-Term Review will determine progress being made toward the achievement of outcomes and will identify course correction if needed. It will focus on the effectiveness, efficiency and timeliness of project implementation; will highlight issues requiring decisions and actions; and will present initial lessons learned about project design, implementation and management. Findings of this review will be incorporated as recommendations for enhanced implementation during the final half of the project's term. The organization, terms of reference and timing of the mid-term review will be decided after consultation between the parties to the project document. The Terms of Reference for this Mid-term review will be prepared by the UNDP CO based on guidance from the Regional Coordinating Unit and UNDP-GEF. The LDFC/SCCF AMAT (as set out in the Project Results Framework in Section III of this project document) will also be completed during the mid-term evaluation cycle.

199. **End of Project**: An independent Terminal Evaluation will take place three months prior to the final PB meeting and will be undertaken in accordance with UNDP-GEF guidance. The terminal evaluation will focus on the delivery of the project's results as initially planned (and as corrected after the mid-term review, if any such correction took place). The terminal evaluation will look at impact and sustainability of results, including the contribution to capacity development and the achievement of global environmental benefits/goals. The Terms of Reference for this evaluation will be prepared by the UNDP CO based on guidance from the Regional Coordinating Unit and UNDP-GEF. The LDFC/SCCF AMAT as set out in the Project Results Framework in Section III of this project document) will also be completed during the terminal evaluation cycle. The Terminal Evaluation should also provide recommendations for follow-up activities and requires a management response, which should be uploaded to PIMS and to the UNDP Evaluation Resource Center (ERC).

200. **Learning and knowledge sharing**: Results from the project will be disseminated within and beyond the project intervention zone through existing information sharing networks and forums.The project will identify and participate, as relevant and appropriate, in scientific, policy-based and/or any other networks which may be of benefit to project implementation through lessons learned. The project will identify, analyze, and share lessons learned that might be beneficial in the design and implementation of similar future projects. There will be a two-way flow of information between this project and other projects of a similar focus.

**Table 10:** Project Monitoring and Evaluation.

| **Type of M&E activity** | **Responsible Parties** | **Budget US$** *Excluding project team staff time* | **Time frame** |
|---|---|---|---|
| Inception Workshop and Report | ▪ Project Manager (MEE)<br>▪ PIU<br>▪ UNDP CO, UNDP GEF | Indicative cost: 10,000 | Within first two months of project start up |
| Measurement of | ▪ UNDP GEF RTA/Project | To be finalized in | Start, mid and end |

| Type of M&E activity | Responsible Parties | Budget US$ *Excluding project team staff time* | Time frame |
|---|---|---|---|
| Means of Verification of project results. | Manager will oversee the hiring of specific studies and institutions, and delegate responsibilities to relevant team members.<br>▪ PIU, esp. M&E expert | Inception Phase and Workshop. | of project (during evaluation cycle) and annually when required. |
| Measurement of Means of Verification for Project Progress on *output and implementation* | ▪ Oversight by Project Manager (MEE)<br>▪ PIU, esp. M&E expert<br>▪ Implementation teams | To be determined as part of the Annual Work Plan's preparation.<br><br>Indicative cost is 20,000 | Annually prior to ARR/PIR and to the definition of annual work plans |
| ARR/PIR | ▪ Project manager (MEE)<br>▪ PIU<br>▪ UNDP CO<br>▪ UNDP RTA<br>▪ UNDP EEG | None | Annually |
| Periodic status/ progress reports | ▪ Project manager and team | None | Quarterly |
| Mid-term Review | ▪ Project manager (MEE)<br>▪ PIU<br>▪ UNDP CO<br>▪ UNDP RCU<br>▪ External Consultants (i.e. evaluation team) | Indicative cost: 30,000 | At the mid-point of project implementation. |
| Terminal Evaluation | ▪ Project manager (MEE)<br>▪ PIU<br>▪ UNDP CO<br>▪ UNDP RCU<br>▪ External Consultants (i.e. evaluation team) | Indicative cost : 45,000 | At least three months before the end of project implementation |
| Audit | ▪ UNDP CO<br>▪ Project manager (MEE)<br>▪ PIU | Indicative cost per year: 3,000 (12,000 total) | Yearly |
| Visits to field sites | ▪ UNDP CO<br>▪ UNDP RCU (as appropriate)<br>▪ Government representatives | For GEF supported projects, paid from IA fees and operational budget | Yearly for UNDP CO, as required by UNDP RCU |
| **TOTAL indicative COST**<br>Excluding project team staff time and UNDP staff and travel expenses | | US$ 117,000 | |

## 7. LEGAL CONTEXT

201. This document together with the CPAP signed by the GRZ and UNDP which is incorporated by reference constitute together a Project Document as referred to in the Standard Basic Assistance Agreement (SBAA) and all CPAP provisions apply to this document.

202. Consistent with the Article III of the SBAA, the responsibility for the safety and security of the implementing partner and its personnel and property, and of UNDP's property in the implementing partner's custody, rests with the implementing partner.

203. The implementing partner shall:

a) put in place an appropriate security plan and maintain the security plan, taking into account the security situation in the country where the project is being carried; and
b) assume all risks and liabilities related to the implementing partner's security, and the full implementation of the security plan.

204. UNDP reserves the right to verify whether such a plan is in place, and to suggest modifications to the plan when necessary. Failure to maintain and implement an appropriate security plan as required hereunder shall be deemed a breach of this agreement.

205. The implementing partner agrees to undertake all reasonable efforts to ensure that none of the UNDP funds received pursuant to the Project Document are used to provide support to individuals or entities associated with terrorism and that the recipients of any amounts provided by UNDP hereunder do not appear on the list maintained by the Security Council Committee established pursuant to resolution 1267 (1999). The list can be accessed via http://www.un.org/Docs/sc/committees/1267/1267ListEng.htm. This provision must be included in all sub-contracts or sub-agreements entered into under this Project Document.

## 8. ANNEXES (SEE SEPARATE DOCUMENT)

**Project Title:** Strengthening climate information and early warning systems in Eastern and Southern Africa for climate resilient development and adaptation to climate change – Zambia

**UNDAF Outcome(s):** (2) Targeted populations in rural and urban areas attain sustainable livelihoods; (3) Vulnerable people in Zambia have improved quality of life and wellbeing by 2015 Human Development; (4) People's vulnerability reduced from the risk of Climate Change, natural and man-made disasters and environmental degradation; and (5) Targeted government institutions provide human rights-based policies, frameworks and services.

**UNDP Strategic Plan Environment and Sustainable Development Primary Outcome:** Promoting adaptation to climate change.

**Expected CP Outcome(s):** 2.1) Government and partners enable vulnerable populations to be food secure by 2015; 4.1) Disaster Management and Mitigation Unit (DMMU) has a fully functional national disaster management and early warning system to prevent, alert and respond to disasters by 2015; 4.2) Government promotes adaptation and provide mitigation measures to protect livelihoods from climate change by 2015; and 4.3) Government implements policies and legal frameworks for sustainable community based natural resources management by 2015.

**Expected CPAP Output (s):**2.1.1) Increased access to financial services and agricultural inputs to Small and medium-scale farmers and other vulnerable groups; 4.1.1) A legal framework for coordination of disaster response and management is developed; 4.2.1) Increased adoption of sustainable land management and agriculture practices to adapt to risks of climate change among small scale farmers; 4.2.2) Revised agricultural and land policies and legal frameworks reviewed to take into account climate change; and 4.3.1) Functional mechanisms to ratify/ domesticate conventions on biodiversity conservation, combating desertification, climate change, ozone depleting substances, water and Convention on International Trade in Endangered Species; and 4.3.3) Increased environment awareness at national and local levels.

**Executing Entity/Implementing Partner:** Ministry of Transport, Works, Supply and Communication (Zambia Meteorological Department)

**Implementing Entity/Responsible Partners:** Disaster Management and Mitigation Unit (DMMU), Department of Water Affairs (DWA)/Water Resource Management Authority (WRMA), Ministry of Agriculture and Livestock (MAL), Ministry of Health (MoH), Central Statistics Office (CSO), and Interim National Climate Change Secretariat (INCCS).

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|---|---|
| Programme Period: | 2013-2017 |
| Atlas Award ID: | 00074216 |
| Project ID: | 00086729 |
| PIMS # | 5091 |
| Start date: | September 2013 |
| End Date | September 2017 |
| Management Arrangements | NIM |
| PAC Meeting Date | 31 July 2013 |

| | |
|---|---|
| Total resources required | US$ 17,531,947 |
| Total allocated resources: | US$ 17,531,947 |
| • GEF/LDCF | US$ 4,000,000 |
| • Government (In Kind) | US$ 3,746,947 |
| • UNDP (Grant) | US$ 600,000 |
| • UNDP (Cash) | US$ 400,000 |
| • Other | US$ 8,785,000 |

***Agreed by (Government)**:*

NAME SIGNATURE

Date/Month/Year

***Agreed by (Executing Entity/Implementing Partner):***

NAME SIGNATURE

Date/Month/Year

***Agreed by (UNDP):***

NAME SIGNATURE

Date/Month/Year