PROJECT DOCUMENT

SECTION 1: PROJECT IDENTIFICATION

1.1 Project title: Development of tools to incorporate impacts of climatic variability and change, in particular floods and droughts, into basin planning processes

1.2 Project number: GFL/
PMS:

1.3 Project type: FSP

1.4 Trust Fund: GEF

1.5 Strategic objectives: IW-1: Enhanced capacity for issues of climatic variability and change (and groundwater management)

1.6 UNEP priority: Ecosystem management

1.7 Geographical scope: Regional multi-country

1.8 Mode of execution: External

1.9 Project executing organizations: DHI, IWA

1.10 Duration of project: 48 months
Commencing:
Completion:

1.11 Cost of project	**US$**	**$22,464,842**	**%**
Cost to the GEF Trust Fund		4,090,000	18.21%
Co-financing			
Cash			
	UNEP-DHI	100,000	0.45%
In-kind			
	UNEP	733,000	3.26%
	DHI	11,277,000	50.20
	IWA	2,919,842	13.00
	National Govts & Agencies	7,435,000	33.10
Total		**22,464,842**	100

Project summary

The project *Development of tools to incorporate impacts of climatic variability and change, in particular floods and droughts, into basin planning processes* will be implemented by the United Nations Environment Programme (UNEP), and executed by the International Water Association (IWA)[1] and the DHI[2].

The project rationale is based on the recognition that climatic variability and change is being increasingly experienced in the form of more frequent, severe and less predictable floods and drought events. There is a growing sense of urgency among countries, basin organizations and other end users such as utilities, of the need to build resilience towards floods and droughts as an integral part of the management of water resources. The growing risks related to hydrologic uncertainty are magnified in transboundary contexts, where cooperation among countries is essential to any coping strategy.

Consequently, the IW focal area of the GEF has identified the increased frequency and unpredictability of floods and droughts as a priority concern in transboundary contexts, along with the other multiple drivers that cause depletion and degradation of shared water resources. In its focal area strategy, GEF IW is emphasizing the need to address the multiple priority stresses – including floods and droughts - impacting transboundary basins, through a multi-country cooperative effort that would enable the needed coordinated mitigation response. As recommended by the GEF, such multi-country effort should be informed by, and start with a basin-wide Transboundary Diagnostic Analysis (TDA) including consideration of increased climatic variability and change, in particular floods and droughts. Hence the need for a science based methodological approach to integrate floods and droughts in this analysis. In more general terms, there is a need for a technically and economically feasible and scientifically sound way to help land, water and urban area managers to integrate the information on increased frequency, magnitude and unpredictability of flood and drought events into different scales of planning processes including integrated water resource management plans (IWRM) at the basin level and water safety plans (WSP) at the local level.

The project will try to respond to these needs by developing a methodology for basins, which uses tools and decision support systems that would allow the integration of information on floods and droughts to (i) the GEF IW TDA-Strategic Action Plan (SAP) or equivalent process, and (ii) IWRM plans and WSPs. The methodology will be based on an assessment of present approaches, and developed through consultation with stakeholders and experience exchange in selected basins representative of different transboundary contexts. There will also be testing on the ground in those same pilot basins.

Most advanced commercially available Decision Support Systems (DSS) combine databases, models, GIS and web technologies with configurable decision logics. This information is processed in such a way that it allows basin organizations and water managers in countries to produce various scenarios that can allow them to make informed decisions on relevant management options (e.g. zoning, early warning systems, water infrastructures) and provide answers to important management questions. As part of the project, open access modules will be developed to allow the

[1] The International Water Association (IWA) is the global network of 10,000 water professionals spanning the continuum between research and practice and covering all facets of the water cycle (www.iwahq.org)

[2] DHI (name until year 2000: Danish Hydraulic Institute) is an independent, consulting and research not for profit foundation (www. dhigroup.com)

integration of flood and drought elements and of likely climatic scenarios into more commonly used DSSs, and apply them to IWRM planning, to the TDA process, and to WSPs. The Water Safety Plan approach will be used to complement wider basin planning as it provides a more in depth engagement with key stakeholders and their legitimate concerns about risk assessment and management options within their boundaries as well as those in the wider river basin context. A particular emphasis will be placed on the management of floods and droughts affecting urban and industrial areas that are the centers of economic growth, assets and wealth creation. Furthermore the engagement with key economic stakeholders depending on sound river basin management can be deepened and lead to a wider appreciation of river basin management benefits, at the national and transboundary levels.

Project Framework

Component	Outcome	Output
Component 0: Project Preparation (includes all PPG outcomes and outputs), and Inception Activities		1) Enhanced focus and effectiveness of final project design achieved through the assessment of current practices in addressing F&D impacts as part of planning processes in transboundary basins including the identification during project preparation of three transboundary basins for particpatory development and pilot testing of the new methodology and tools. 2) Project Inception with the participation of GEF Project Agencies and of Pilot Basins representatives. *(Project)*
Component 1 Development of Methodology and Tools	**Outcome 1.1** A methodology with DSS tools aimed at increasing understanding of F&D dynamics and impacts at transboundary and national levels and including enhancement of commonly used decision support systems, fully developed jointly with pilot basins stakeholders.	1) A methodology with DSS tools adopting a basin approach, including enhancements for decision support systems, that would allow the integration of F&D consideration into (i) the TDA-SAP GEF IW or equivalent processes, and (ii) IWRM plans and Water Safety plans (DHI & IWA). 2) Guidance materials for the application of the Methodology with DSS tools (DHI)
Component 2 Application and testing at basin-wide level	**Outcome 2.1** Application of the methodology with DSS tools in the three pilot basins enables the integration of F&D consideration into the IWRM, TDA-SAP, Water Safety and other planning processes.	1) Strategic recommendations for inclusion of flood and droughts consideration in IWRM, TDA, Water-Safety and other basin land and water planning tools in the 3 selected pilot basins (DHI & IWA).
Component 3 Validation and testing at local level	**Outcome 3.1** Uptake of the methodology with DSS tools at lower administrative levels within the 3 pilot basins enables water suppliers and regulators, (agro) industries and urban area managers to consider options for increased resilience and preparedness to F&D within	1) Downscaled methodology with DSS tools for integration in at least 3 urban areas with urban and (agro)industrial water users perspectives and realities in floods and droughts planning at basin level (IWA & DHI). 2) Recommendations for updated

	broader basin context with an emphasis on vulnerable groups affected by water related shocks.	plans, including investments, for utility water safety, urban drainage and socio-economic urban areas vulnerable to F&D, incorporating basin level constraints and outlooks (IWA).
Component 4 Capacity building and dissemination	**Outcome 4.1** Experience and know how gained through the project is made available within the GEF system and beyond. **Outcome 4.2** Global dialogue on water security and climate resilience enriched by the dissemination of and awareness raising on project outcomes	1) Learning package including technical specifications and training materials for the application of the new methodology with DSS tools is tested in 2-3 trainings with basin officials, utility and industry management and operational staff, and representatives from civil society with 15-30 people per training (DHI & IWA). 2) 2-3 Experience Notes and other documents and audio-visual materials produced for IW LEARN dissemination mechanisms and website. (IWA) 3) Communication materials (4-5) developed for and participation in major water events: WWF, Water Week, GEF IWC 8/9, and IWA Conferences (IWA).

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Acronyms and Abbreviations

APR	Annual Performance Report
BMA	Bangkok Metropolitan Administration
BOD	Biochemical Oxygen Demand
CBA	Cost-Benefit Analysis
CEB	Electricity Community of Benin
CEET	Togolese Electric Energy Company
COWI	Consulting Engineers
CTBV	Technical Committee of the Volta Basin
DEPI	Division of Environmental Policy Implementation
DHI	Former Danish Hydraulic Institute
DNV	Det Norske Veritas
DRB	Danube River Basin
DRBM	Danube River Management Plan
DSS	Decision Support Systems
DWR	Department of Water Resources
EAC	East African Community
EC	European Commission
ECOWAS	Economic Community of West African States
EGAT	Electricity Generating Authority Thailand
EOU	Evaluation and Oversight Unit
EU	European Union
FAO	Food and Agricultural Organization
GAMS	General Algebraic Modeling System
GCM	Global Circulation models
GDP	Gross Domestic Product
GEF	Global Environment Facility
GEUS	Danmarks og Grønlands Geologiske Undersøgelse
GIS	Geographic Information System
GLOWA	Global Change in the Hydrological Cycle
GVP	GLOWA Volta Project
GWP	Global Water Partnership
HAII	Hydro and Agro Informatics Institute

HDI	Human Development Index
HEC-RAS	US Army Corps of Engineer's Hydrologic Engineering Centre's River Analysis System
HSD	Hydrological Service Department
ICDPR	International Commission for Protection of Danube River
INBO	International Network of Basin Organizations
IUCN	International Union for the Conservation of Nature
IW	International Waters
IWA	International Water Association
IWC	International Waters Conference
IWMI	International Water Management Institute
IWRM	Integrated Water Resources Management
JICA	Japanese International Cooperation Agency
KIWASCO	Kisumu Water and Sewerage Company
LDD	Land development Department
LEARN	Learning Exchange and Resource Network.
LME	Large Marine Ecosystem
LVBC	Lake Victoria Basin Commission
LVEMP	Lake Victoria Environmental Management Program
LVSWSB	Lake Victoria South Water and Sewerage Board
LVWATSAN	Lake Victoria Water and Sanitation
MCA	Multi-Criteria Analysis
MEST	Ministry of Environment, Science and Technology
MSP	Mountain Spring Pipeline
MWA	Metropolitan Waterworks Authority
MWAUWASA	Mwanza Urban Water and Sanitation Authority
NBI	Nile Basin Initiative
NEB	National Environment Board
NESDB	National Economic and Social Development Board
NWRC	National Water Resources Committee
OECD	Organisation for Economic Co-operation and Development
ONEA	Office National de l'Eau et de l'Assainissement
ONWRC	Office of the Natural Water Resources Committee
PIR	Project Implementation Review
PMS	Project Management System

PMU	Project Management Unit
POS	Purchase Order System
PPG	Project Preparation Grant
PWA	Provincial Waterworks Authority
RC	Runoff Coefficient
RCM	Regional Climate Models
RID	Royal Irrigation Department
SAP	Strategic Action Plan
SBEE	Benin Society for Electrical Energy
SC	Steering Committee
SONABEL	Société Nationale d'électricité du Burkina
SONEB	La Société Nationale des Eaux du Bénin
SUWASA	Sustainable Water and Sanitation in Africa
SWAT	US Department of Agriculture's Soil and Water Assessment Tool
TDA	Transboundary Diagnostic Analysis
TMD	Thai Meteorological Department
TNMN	Trans National Monitoring Network
UN	United Nations
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNOPS	United Nations Office for Project Services
USAID	United States Agency for International Development
USEPA	United States Environmental Protection Agency
UVBMA	Upper Volta Basin Management Agency
VBA	Volta Basin Authority
VB-WAS	Volta Basin Water Allocation System
VRA	Volta River Authority
WAPP	West African Power Pool
WB	World Bank
WFD	Water Framework Directive
WHO	World Health Organization
WMO	World Meterological Organization
WOP	Water Operator Partnerships

WRIS	Water Resources Information System
WSP	Water Safety Plan
WSSD	World Summit on Sustainable Development
WWAP	World Water Assessment Programme
WWF	World Water Forum

SECTION 2: BACKGROUND AND SITUATION ANALYSIS (BASELINE COURSE OF ACTION)

2.1. Background and context

The project rationale is based on the recognition that climatic variability and change is being increasingly experienced in the form of more frequent, severe and less predictable floods and drought events. There is a growing sense of urgency among countries, basin organizations and other end users such as utilities of the need to build resilience towards floods and droughts as an integral part of the management of water resources. The growing risks related to hydrologic uncertainty are magnified in transboundary contexts, where cooperation among countries is essential to any coping strategy.

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Introduction to Floods

Flood plains have through time been a preferred place for human settlement and socio-economic development because of their proximity to rivers, guaranteeing rich soils, abundant water supplies and means of transport. Floods play an important role in such areas in maintaining the ecological and natural functions of rivers: they may replenish wetlands, recharge groundwater and support fisheries and agriculture systems thereby supporting livelihoods of people.

However, floods also represent a significant risk to communities, when people and their activities are exposed to flooding without considering the potential negative impacts. Floods can produce severe adverse impacts on the economy and people's safety. Mega cities and important economic activities (e.g. agriculture and industries) for national economies have been located in flood plains despite the awareness of the detrimental impacts of flood. In fact, every year many countries around the globe face serious floods and major damages, and large populations have to adapt their life to such conditions.

The hydrological processes responsible for flood generation are continuous and interrelated across a river basin. There is a close relation between water resource management, river management, land use management, forest management, erosion control, agriculture, urban drainage and sewerage within a basin. Changes in catchment characteristics may influence the characteristic and magnitude of flood regime. Flood management measures at one location of the basin may have impacts on the magnitude of floods downstream thereby contributing to transfer of flood risks within the river basin. The flood management measures therefore should take account of the entire basin from upstream to downstream.

Basin flood management and planning should as much as possible adhere to the overall vision and policy of IWRM (with special attention on flood issues). The designated authority or group of authorities that have responsibilities of flood management must be involved in the overall integrated basin management and planning.

As for many other types of integrated water resources management and planning, there is a need for tools, which can assist in the specific requirements of controlling and alleviating the impacts of floods including providing early warning of unexpected flood events. Such tools must recognize and help in solving important pressure – impact relationships such as:

- A river basin is dynamic over time and space, and there is often a series of interactions between water, soil/sediment and pollutants/nutrient to take into account;
- Population growth and economic activities exert increasing pressure on the natural system;
- Increased economic activities in floodplains increase vulnerability to flooding;
- High level of investment in floodplains, and the lack of alternative land in many countries, means that abandoning flood-prone areas is not a viable option for flood damage reduction;
- Changes in land use across the basin affect runoff and the probability of a flood of a given magnitude;
- Changes in the intensity and duration of precipitation patterns as a result of climate change can increase flash floods and seasonal floods.
- The likelihood that existing flood protection measures could fail and how such situations should be managed need to be considered.
- Proper management of existing flood infrastructures, such as dams, levees, diversion canals etc.
- Riverine aquatic ecosystems provide many benefits such as: clean drinking water, food, flood mitigation and recreational opportunities.
- A trade-off between competing interests in a river basin is required to determine the magnitude and variability of the flow regime needed within a basin to maximize the benefits to society and maintain a healthy riverine ecosystem.

Therefore the strategy for flood risk reduction may have to be realized through a basin flood management. Organizations and institutions with mandates related to development activities as well as the management and operation of infrastructures that affect the hydrological processes in the basin must be counted as stakeholders in the process of formulating basin flood management schemes.

Decision Support Systems for flood management and planning are required for the use of policy makers and flood practitioners to guide the operational procedures of basin flood management and planning. This involves early warning systems to be operated in real-time as well as the management of the water in the river and flood plains in between and under flood events.

Introduction to droughts

Similar to flooding, drought is an equally important issue for integrated water resources management and planning as well as environmental protection. Climatic variability in time and space may cause periods with low rainfall and runoff insufficient to sustain the normal requirements for water for basic human needs as well as agricultural and industrial production. Unsustainable water management, including over-exploitation and water pollution, as well as predicted climate change effects in droughts, could result in severe impacts on nature and communities, which can have significant impacts on the national economy in many countries.

Inefficient management of water resources in periods of droughts can also put aquatic ecosystems under higher stress. The lack of adequate water use planning may lead to significant overexploitation of surface water, which jeopardizes the survival of associated fauna and flora. It is therefore essential to establish and develop measures to minimize socioeconomic and environmental impacts, of drought effects in the context of IWRM.

Managing the local water buffer through recharge, retention and reuse is of vital importance – it determines livelihoods of people and the economy of an area. Groundwater is key to managing the buffer function – allowing one to deal with current peaks and lows and the larger variability that in many areas is expected to come with climate change. One important water buffer is the storage provided in the upper meters of soil and in shallow aquifers. In many places this groundwater buffer can be used to store rainwater and run-off, augmented by flows from rivers and irrigation, making it possible to re-circulate and re-use water. In a broader sense a local water crisis, such as drought, is not so much about allocating scarce water, but to catch water and extend the chain of water use and its reuse as much as possible within a basin, taking account of all people and the environment across entire basins. This project recognizes the important buffering role groundwater resources play and will promote the conjunctive management of surface and groundwater in the drought scenarios analyzed.

In contrast to water scarcity, which is a permanent situation where insufficient water resources are available to satisfy long-term average requirements, droughts represent temporary decrease of the average water availability in relation to important deviations from the average levels of natural water availability. In most countries around the World drought events occur regularly. However the duration of each event and the area and population affected may vary. It is not possible to control the occurrence of droughts, but the resulting impacts may be mitigated to a certain degree through appropriate surveillance and management strategies developed in drought management plans. As in the case of floods, drought may have impact across a basin and be alleviated through appropriate planning and management throughout the river basin.

To determine the onset of a drought event, operational definitions usually specify the degree of departure from average of the climatic variable under consideration over some time period. This is done by comparing the current situation to the historical average, which is often based on a multiyear record period. Operational definitions can also be used to analyze drought frequency, severity, and duration for a given historical period.

Drought differs from many other natural disasters in its slowness of onset and its commonly lengthy duration and possible spatial difference between the deficiency of precipitation itself and the occurrence of drought. Although it is a natural hazard, drought may to be aggravated by climate change in many regions.

Decision Support Systems for drought planning and management should provide the decision makers with an effective and systematic means of assessing drought conditions and the future outlook, developing mitigation actions and programs that reduce in advance the effects of drought,

and developing response options to minimize economic stress, environmental losses, and social hardship during drought. They may consider the following elements:

- Services and system overview (a general description of the registered services for water allocation to which drought management applies, the infrastructure for supplying water and the current and future demands);

- Evaluation of the potential for the strategic utilization of groundwater resources, less impacted by climatic fluctuations, including utilization of deeper aquifers, storage of flood waters and of treated wastewaters, and the full development of the potentialities in terms of drought mitigation offered by conjunctive surface and groundwater management.

- Assessment of available water sources (identification and assessing the available water sources including possible future and emergency sources). Such an assessment may address the historic performance of the existing source/s of supply and consider the quantity of water available, the water quality and any impacts of climatic effects.

- System operational and management strategies (addressing consumption patterns by the various categories of water users in the community (for example, residential, commercial, industrial, irrigation, stock and domestic, irrigation and other), the location of those users and identify strategies that can be implemented to minimize the detrimental social and economic impacts of the drought and water shortages on the community. It may specify the trigger points adopted for the imposition of restrictions in order to minimize the social and economic impacts on the individual communities, who is responsible for managing drought and the organizational structure for implementation of the strategy.

2.2. Global significance

By improving the ability of river basin managers to predict and manage situations of flood and drought, this project can potentially have a positive effect on the livelihoods of millions of people who reside and work in transboundary basin areas. With a particular emphasis on the urban centres in these basins, the potential impact of the project could be transformative in many ways. Basin residents, as well as many others living outside the basin areas, are dependent on the ecosystem goods and services that are produced with water from these basins. These goods and services and their wise management could be a key component of managing floods and droughts. Yet, many of these goods and services are negatively impacted in situations of flood and drought. In Africa especially, both floodplains and drought prone areas are often inhabited by marginalized communities and/or informal settlements. Women's roles as water custodians at the household level in procuring water for basic human needs and subsistence farming are also of special concern. Key beneficiaries of a wise use are the communities that are inhabiting flood or drought prone zones themselves, as well as downstream urban centres that benefit from continuous supplies in cases of drought or flood attenuation in cases of floods. In addition are other goods and services and productive activities such as agriculture, travel, domestic and industrial water supply, tourism and lesuire, aquaculture and not least power generation, which is heavily reliant on water for both generation and cooling services.

This project directly strengthens the implementation of integrated water resources management (IWRM), an approach based not only on environmental considerations, but also on the greater involvement of all stakeholders, including women, in water resources management.

2.3. Threats, root causes

Recent weather events such as deadly heat waves and devastating floods have sparked interest in understanding the role of global warming in driving extreme weather. These events are part of a new pattern of more extreme weather across the globe. As the climate has warmed, some types of extreme weather have become more frequent and severe in recent decades, with increases in extreme heat, intense precipitation, and drought. Heat waves are longer and hotter. Heavy rains and flooding are more frequent. All weather events are now influenced by climate change because all weather now develops in a different environment than before. While natural variability continues to play a key role in extreme weather, growing climatic variability and change has shifted the odds and changed the natural limits, making certain types of extreme weather more frequent and more intense.

Weather variation on our planet can be described with a rough bell-shaped curve. So-called normal weather is very common while extreme weather is rare. While events close to normal occur frequently, in the broad center of the curve, there is a sharp fall-off in the frequency of events further away from normal, in the flatter ends of the curve. For instance, a small increase in temperature shifts the entire curve toward hotter high temperatures. The most rare and extreme record heat events become even more severe and much more frequent. Precipitation does not follow quite the same pattern, but the same concept applies: fewer light and moderate rains are being replaced by more heavy rain events. Changes in precipitation are quite complex, and current computer models of climate have only a limited ability to predict the heaviest precipitation. Recent observed changes in precipitation have been even greater than the changes projected by climate models. Even with their limitations, current models still capture the physical processes associated with the observed increases in intense precipitation. Warmer air holds more moisture. That additional moisture fuels increases in precipitation intensity. This has been measured in real-world observations as well as simulated by climate models.

Changes in extreme weather threaten human health as well as prosperity. Many societies have taken measures to cope with historical weather extremes, but new, more intense extremes have the potential to overwhelm existing human systems and structures. More frequent and more severe extreme weather events are more likely to destabilize ecosystems and cripple essential components of human livelihood, such as food production, transportation infrastructure, and water management. Death, disease, displacement, and economic hardship may follow, as we have seen with recent hurricanes, floods, heat waves, and droughts[3].

[3] Weather variability can be extremely costly. One estimate finds that the total U.S. economic output varies by up to $485 billion/year owing to weather variability. From 1980 to 2010 there were 99 weather disasters in the U.S. in which damages exceeded $1 billion. Altogether those disasters cost $725 billion. In 2011, the costs of all weather-disaster damages so far have climbed past $35 billion, according to NOAA estimates. As of August 30th, the U.S. has witnessed 10 weather disasters costing over $1 billion each. This breaks the previous record for the number of such U.S. weather disasters in an entire year. (from Climatecommunication.org)

Climate change has affected river basins, as noted in the Transboundary Diagnostic Analyses and NAPAs, of many GEF initiatives, and therefore climate hazards such as droughts and floods are becoming more intense and frequent and exacerbating the impact of other stressors. Sector managers from transboundary basins lack the capacity to address climate change and mainstream provisions for extreme events into their ongoing basin IWRM, Strategic Action Program, Water Safety and other planning processes.

2.4. Stakeholder mapping and analysis

A variety of stakeholders are engaged in the project ranging from global to local level. The project was initially requested by GEF, as the increased frequency and unpredictability of floods and droughts were identified as a priority concern in transboundary contexts, along with the other multiple drivers that cause depletion and degradation of shared water resources. GEF identified the need to include a science based methodological approach to integrate floods and droughts into basin wide Transboundary Diagnostic Analyses. UNEP has a strong stake in the project as the implementing agency, but also as a global organization, which aims to provide leadership and encourage partnership on environmental issues (including addressing the causes and impacts of floods and droughts) with its member states.

A number of international organizations with varied mandates are also key stakeholders as they will be able to use the project outputs to address floods and droughts from basin to local level. In addition, the project will complement ongoing initiatives and research. Among them, the Flood Hazard Research Centre is developing manuals that incorporate data on flood damages as well as the impacts of floods, as well as the ongoing work of IUCN on disaster risk reduction, and ecosystem-based adaptation to climate change impacts (which includes floods and droughts). WHO's Integrated Flood Management Program is another important ongoing initiative.
The executing agencies are well placed to reach out to their networks to ensure project outputs are used effectively beyond the project lifetime and are integrated into planning and implementation processes. DHI is able to do this through the wide application of basin decision support systems that have been developed, and the floods and droughts modules in this project will add to existing DSS. IWA is a network of water professionals, which includes utilities and industries. Demonstrating the applicability of the DSS to better integrate flood and drought information into water management will ensure that key users within basins are able to address water related risks. This will be achieved through training and application of the DSS in basin and urban context with key stakeholders which include basin organizations and urban water managers.

Other companies and organizations that develop DSS are also important stakeholders as they will be able to take up the modules and approaches developed and apply it to other situations. This will provide an opportunity to scale up the project products and replicate its approach in different contexts.

Basin organizations and water users within basins will be some of the primary beneficiaries of the methodology developed through the project. There is a need for a technically and economically feasible and scientifically sound way to help land, water and urban area managers to integrate the information on increased frequency, magnitude and unpredictability of flood and drought events into planning processes including integrated water resource management plans (IWRM) at the basin level and water safety plans (WSP) at the local level. From the catchment authority

perspective, all stakeholders including utilities need to take part in catchment management including responding and mitigating floods and droughts. Monitoring and sharing of data is important, and this project provides the scope for utilities (including industry) and catchment authorities to work together to ensure data is shared, analysed and used to make decisions on how resources are applied for effective basin management. From the utilities and industry perspective, more active involvement in catchment management includes being part of the planning process, which the project will enable by integrating their needs into flood and drought planning at the basin and local level. Development of the DSS with these primary beneficiaries will be able to identify how flood and drought information can be clearly integrated into planning and implementation of responses to these water related risks.

Type	Project Implementation Roles
International level	GEF (consultation and collaboration), UNEP (GEF Agency), UNEP-DHI Centre (executing partner), DHI (DSS support and implementation), IWA (approach testing in cities-bains, dissemination and stakeholder engagement – utilities & industry), GWP (consultation on transboundary IWRM), World Bank (assistance with development and outreach), Flood Hazard Research Centre (technical input), International Water Association (technical input), IUCN (technical input), UNESCO (technical input), INBO (assistance in identification of transboundary basin partners, World Meteorological Office (technical input), UN-Water (technical input), GEUS (technical input), IUCN – Technical support (ecosystem services, basin management); IW:Learn (technical input and collaboration).
Pilot Basin Level	Within the pilot basins it will be important to draw upon a broad range of stakeholders including but not limted to Transboundary River Basin Organisations (technical input and collaboration), local authorities, representatives of local and indigenous communities that inhabit flood or drought prone areas of the pilot basins, urban and (agro) industrial water users and civil society groups. Also ministries responsible within regional economic commissions and catchment organizations, national and regional environment. institutions, universities, research organisations, NGOs, fisheries community, water utilities, farmers, industries, media, women groups

2.5. Baseline analysis

GEF has an extensive portfolio that includes more than 50 IWRM-related projects in 30 lake and river basins throughout the world. The baseline project includes the project partners' efforts to incorporate tools, such as hydrological Decision Support Systems (DSSs) and water safety plans, into basin-level planning and management. The partners' contributions to the baseline project are elaborated below:

UNEP's current Program of Work includes significant support both to the development and application of IWRM and to building resilience to the adverse environmental impacts, including floods and droughts. Under the Sub-Program on Ecosystem Management UNEP supports countries to identify and develop and test tools to strengthen ecosystems functioning for water regulation and purification services, particularly in developing countries (output #311 in the UNEP Programme of Work, Ecosystem Management sub-programme). The tools developed include policy planning; assessment/identification of drivers – in particular climate variability. Under the Sub-

Program for Climate change, UNEP supports countries in building climate resilience of vulnerable human societies, ecosystems and economies through increased understanding of multi-stressor interactions and the mobilization of knowledge, capacities and integrated assessment results to support adaptation policy setting, planning and practices(output #111 in the UNEP Programme of Work, Climate Change sub-programme). The proposed project will build on both the Ecosystem Management and Climate Change sub-programmes of UNEP's existing work and will develop synergies between the two areas.

UNEP-DHI Centre and its host institution, DHI (a not-for-profit foundation), have a wealth of experience in working with IWRM policy and implementation in transboundary settings. In recent years DHI has worked on both identifying and seeking to address the need for systems that support decision-making processes of water managers in river basins. The resulting Decision Support Systems (DSS) combine databases, models, GIS and web technologies with configurable decision logics. This information is processed in such a way that it allows water managers to produce various scenarios that can allow them to make informed decisions and provide answers to important management questions. DHI is currently involved in sizeable test and implementation projects using its DSS in the Nile Basin (all countries), Lake Victoria, Volta Basin, , India, Sri Lanka, Southern Africa and Australia. Depending on what is required and the range of models and tools applied, the analyses produced by the DSS can range from very simple to highly complex, and can be used, for example, for the feasibility testing, planning and design of various water dependent projects within a basin. The baseline project will provide information produced by DSSs to strengthen and support stakeholder engagement as part of TDA/SAP processes. To date, the DSSs developed by DHI have not been designed to explicitly take the more extreme climate events (floods and droughts) into consideration, but the systems can be amended for this purpose.

IWA and partners have developed an approach based on Water Safety Plans to enhance water security for cities, utilities and industries. Water Safety Plans help cities and industries to determine issues within their boundaries and circle of influence as well as those in the wider river basin context. As such it is increasingly seen as a viable approach to engage with a wider set of stakeholders influencing, for example, water intake, groundwater levels, water quality standards, discharge permit criteria etc. In many ways, a Water Safety Plan approach complements wider basin planning and use of basin wide tools in that it provides a more in depth engagement with key stakeholders and their legitimate concerns about wider water planning and use. A key outcome of this approach is arriving at an optimization of water use at the industrial plant / city level. This forms a crucial step for engaging constructively in a wider basin optimization with a broader set of stakeholders and building system resilience in the face of increasing floods and droughts. With urbanization increasing in most basins, the need to better incorporate municipal water concerns into basin-level planning processes becomes paramount. The baseline project includes Water Safety Plan recommendations to support basin-level planning.

In addition, a number of initiatives at the basin and/or country level will also contribute to the baseline project. These will be fully inventoried during the project inception period and documented in the inception report to complete the baseline.

Tools, such as DSSs for hydrological systems and water safety plans and their application in river basins constitute the baseline project. The development of tools, methodologies and DSSs incorporating extreme climate events into management planning through participatory processes

in pilot basins, are the incremental activities[4], described in more detail below, for which GEF support is requested. At the same time project activities will enrich the management of water safety in economically significant urban and industrial areas in the said pilot basins. A close cooperation with basin authorities, utility managers and the broader groups of stakeholders, will ensure that developed methodologies and systems are responsive to the needs and priorities of the users on the ground. . The methodologies in the project refer to management tools and approaches (e.g. zoning, floodplain mapping, response planning) which will be recommended and/or implemented by partners as a result of deploying the DSS in the basins. The expected results will become an integrated part of the GEF TDA/SAP approach, and will on a broader level, lead to increased resilience to floods and droughts not only at the transboundary level, but also on urban and industrial site levels in the targeted basins. Management decisions on the sound science basis, established by the enhanced DSS systems, will inevitably lead to better and more informed balancing of technical, economic, environmental and ecological concerns.

2.6. Linkages with other GEF and non-GEF interventions

The project will, when relevant, seek collaboration with IW: Learn (management assistance and dissemination of results), GWP Toolbox (consultation on DSS design), as well as various flood and drought initiatives by the European Commission[5]. GWP and WMO have been implementing the Associated Program on Flood Management over the past ten years and are in the process of launching a similar joint program on Integrated Drought Management. The Project will enter into a dialogue with GWP and WMO in order to reach an agreement on collaboration and mutual assistance. Further linkages will be built with the IWA Specialist Groups network and the various programs on climate change, floods and drought management. Also a direct link will be established with a range of consultancy agencies that are directly involved in approaches and DSS for floods and drought management. The project will also link with some key global or urban initiatives including the C40 Cities Climate Leadership Group (C40)[6], which is a network of the world's megacities committed to addressing climate change, as well as the ongoing World Bank initiatives on Climate Change (see section 3.1.2) and Sustainable Cities[7], (aims to optimize the economic, financial, social, and environmental sustainability goals of cities). The exact relevance and how the cooperation will take place will be finally defined during the inception period.

SECTION 3: INTERVENTION STRATEGY (ALTERNATIVE)

3.1. Project rationale, policy conformity and expected global environmental benefits

3.1.1 Project rationale

Benefit-sharing, i.e.: the move from the sharing of water quantities to the sharing of the benefits the users receive from its use - has been suggested as a strategy to move towards a cooperative use of international waters. The mitigation of the impacts of increased climate variability, in particular floods and droughts, well exemplifies the potentialities of this approach, as in the case of the provision of flood control benefits for the downstream party through upstream retention measures, and many others. The concept of benefit sharing will

[4] The incremental activities for which GEF support is requested are described in more detail in Section 3: Intervention Strategy
[5] http://www.prepared-fp7.eu/.
[6] http://www.c40cities.org/
[7] http://www.worldbank.org/en/region/eca/brief/sustainable-cities-initiative

inform the development of the methodology, which is the focus of this project, in order to enhance cooperation and trans-boundary dialogue.

GEF's extensive portfolio of more than 50 IWRM-related projects in 30 lake and river basins throughout the world has highlighted the need to include careful consideration of floods and droughts within the International Waters Focal Area Strategy for GEF-5. Indeed, extreme climate events are a reoccurring theme of many TDAs and SAPs. The goal is to be able to combine, consider and address multiple priority stresses for individual water bodies with a view to optimizing water resources management. Introducing flood and drought management Decision Support Systems to support decision-making processes can achieve this.

Tools, such as DSSs for hydrological systems and water safety plans, and their application in pilot basins is a significant part of the baseline project. However, these tools have not been designed to address the increased frequency and unpredictability of extreme climatic events, such as floods and droughts. Floods and droughts add to the challenges of water reources management. As the pressures on water resources increase, so does the urgency of applying sustainable management options. Implementing IWRM is a long term process that is extremely challenging on local and national levels. On a transboundary level these complexities are multiplied, as are the risks of failure. While this project does not seek to directly address all the complexities of addressing climate change impacts in transboundary water management, it does aim to provide the necessary tools for others to do this. Development DSSs which incorporate extreme climate events into management planning processes are the incremental activities for which GEF support is requested. The main value-added by the project will be targeted tools and recommended methodologies to support policy, strategy, planning and implementation to address floods and droughts in a transboundary setting. Floods and drought management DSSs can become invaluable centralized points of reference for guiding essential aspects of effective transboundary water resources management that simply does not exist today. It is only in more recent years that attention has been given to producing guidance and training related to integrated flood and drought management. Furthermore, there is little coherence in the guidance and training on offer.

This project will bring together flood and drought management techniques and tools in a more structured way: A particular emphasis will be placed on approaches to plan for and manage floods and droughts affecting urban and industrial areas which are the centres of economic assets and wealth and engines of economic growth and wealth creation. By focusing on these the protection and wise management of related assets in the face of floods and droughts can be optimized. Furthermore the engagement with key economic stakeholders depending on sound international river basin management can be deepened and lead to a wider appreciation of international river basin management benefits. The development and implementation of the DSS and thus support the choice of management option (e.g. zoning, early warning systems, infrastructures), will be undertaken with basin and urban representatives to ensure that there is agreement on the contents and application of the methodological approach. The emphasis is to build the capacity of the users such that the DSS can be applied beyond the project in the demonstration basins. In addition, it can be envisioned that the demonstration basins can be a source of training and capacity building for application of the generic DSS in other transboundary basins.

- Providing operational value to transboundary river basin management;

- Helping managers and users of the resource to make the right decisions on land management, land use planning, infrastructure development and cross border emergency planning and mitigation in support of longer-term resilience; and,

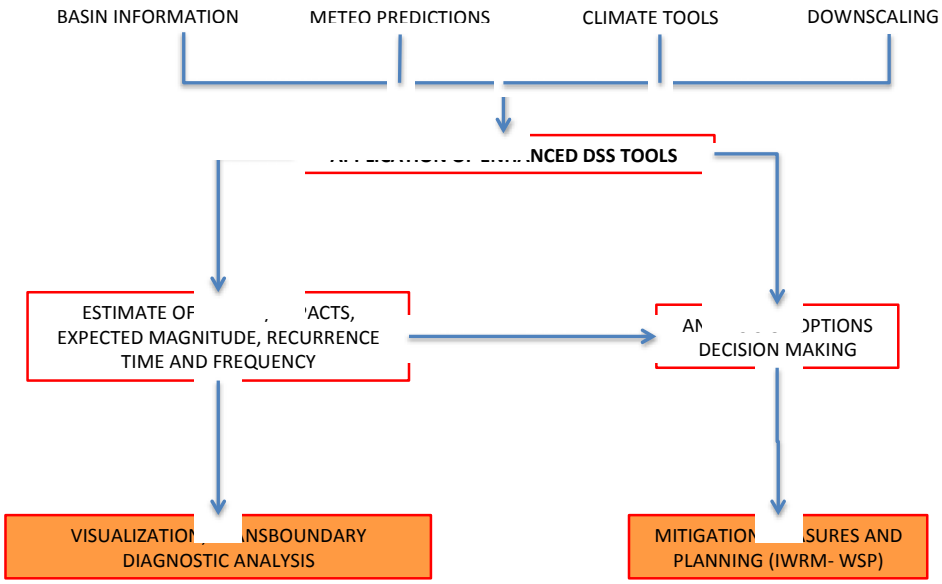
- Ensuring that decisions made to reduce risks and hazards are also supportive of reducing impacts on vulnerable communities and stakeholders as well as sustainable economic development and growth in the longer term.

More specifically, this will be done by creating and disseminating a new science based methodology and tools including the enhancement of decision support systems to address the impacts and the transboundary implications of floods and droughts on human livelihoods, economic activities, and ecosystems and combining analytical tools with expert guidance and an interactive scenario methodology that has been tried and tested by the target audience. The expected results will become an integrated part of the TDA/SAP approach, and on a broader level, will lead to increased resilience to floods and droughts not only at the transboundary level, but also on more local urban and industrial site levels in the targeted basins. As a first step the targets will be appropriate current and planned GEF supported transboundary basin projects. Following this, the initiative will be expanded to as many other GEF and non-GEF supported basins as feasible.

Many GEF IW Strategic Action Programmes, notably the Lake Chad, Senegal, Volta, Plata and Amazon River Basins have highlighted extreme climatic events (e.g. floods and droughts) as a key transboundary threat to shared aquatic ecosystems. Consequently tools such as DSSs, that improve our understanding of extreme climatic events and incorporate these considerations into TDAs/SAPs and other management processes, are a crucial first step in maintaining transboundary ecosystem function and ultimately conserving global environmental benefits in these shared aquatic ecosystems.

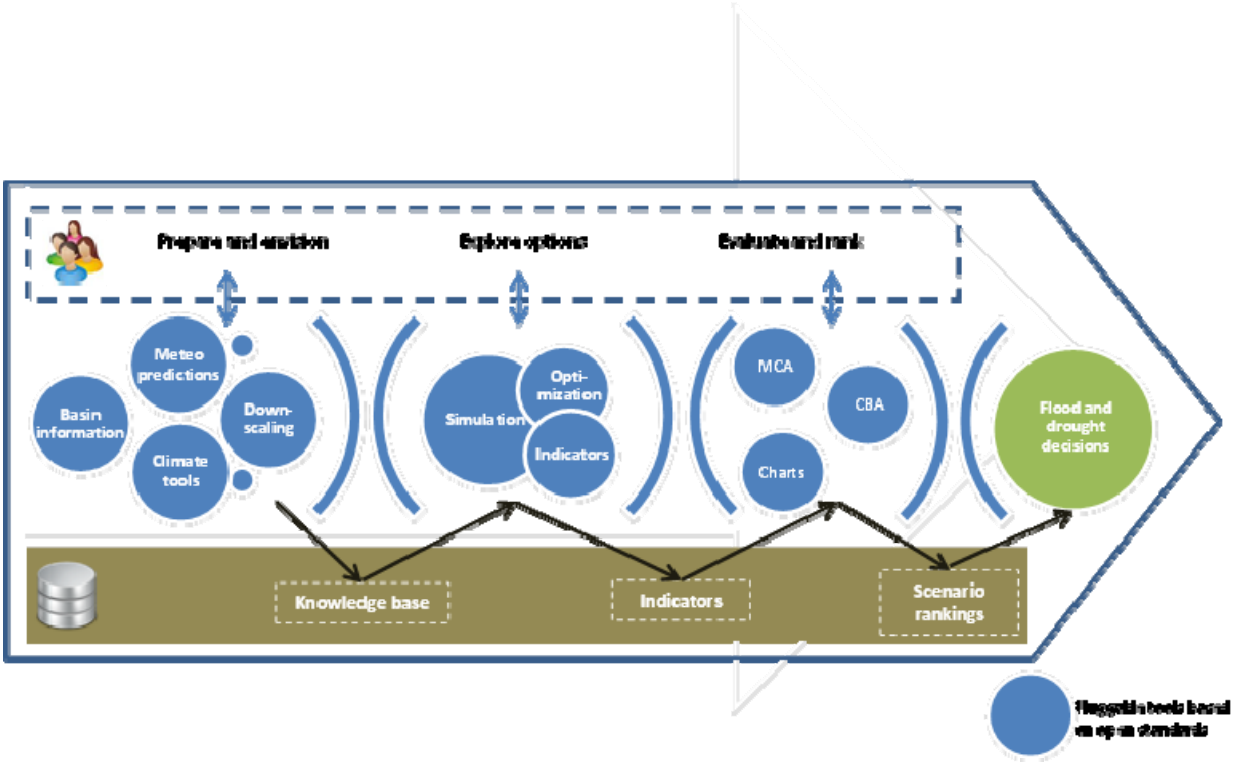
While the application of DSSs to hydrological systems constitutes the baseline project, the modification of these systems to include extreme climate events, and the incorporation of this information into TDA and SAP processes constitutes the GEF increment.

The figure below shows a schematization of the process leading – on one side - to the visualization of impacts, and the integration of F&D into TDAs, and – on the other side - to the decision making on mitigation measures and basin planning.



3.1.2 Overview of Decision Support System (DSS) tools and workflow process

Flood and drought planning and management in transboundary river basins require a comprehensive set of tools for assisting in the prediction, analysis and mitigation of impacts. Decision support in relation to flood and drought management must follow a stringent cause and effect workflow process, based on a reliable knowledge base of information and a well-structured methodology to identify suitable options. The pros and cons of these options will be assessed by the decision maker allowing him to make informed and rational decisions.
Such a workflow process involves several important steps, including: 1) Prepare appropriate input data; 2) Define planning and management options/scenarios and explore these through simulation, with or without optimization, to produce flood and drought indicators; and 3) Evaluate and rank the scenarios using multi-criteria and cost benefit analyses. Ranking as to be made by the decision maker (and relevant stakeholders). All three steps of the process require a toolbox, in which individual tools can be added or substituted depending on the requirements.
In all phases of the workflow, the tools will interact with the underlying data base and user interface of the DSS. The workflow is illustrated in the diagram below.



The diagram illustrates the workflow as consisting of:

1. Preparation of input through tools that can read and transform climate prediction data on an appropriate scale (temporal and spatial) and in formats that can be used by the simulation software;
2. Explore options through simulating the behavior of the physical system (river basin) using preferred mathematical modeling tools. The modeling tools will simulate actual flood or drought conditions, based on climatic conditions, the physical conditions in the basin, as well as operational options for mitigating adverse impacts through relevant surface and groundwater water conjunctive management actions;
3. Condensing the outcome (evaluation and ranking) into easy to understand visualisations and evaluating the scenarios through multi-criteria and cost-benefit analyses leading to acceptable flood and drought mitigation measures at basin and community level. These Transboundary Diagnostic Analysis (TDA) analyses may include optimisation / probabalistic methodologies for defining desired solutions in an objective manner and under prevailing constraints from environmental and socio-economic perspectives.

DHI's implementation of this workflow in the context of transboundary floods and droughts will consist of:

- Establishing the protocols that the tools of the workflow shall follow in order to function together as well as interact with other parts of the DSS in an automatic manner. This will ensure that output from one component immediately can be used by the next and – not least – that diverse DSS owners can enrich their system with plug-in tools (tools that can work with a DSS owners system given that the owner implements a plug specific to the DSS system) ;

- Plug-in tools for reading short-, medium- and long-range meteorological prediction data and transforming them into appropriate formats required by the DSS using innovative down-scaling methodologies.
- Adapters for commercial or freely available, and commonly used simulation modelling codes, e.g. HEC-RAS (US Army Corps of Engineer's Hydrologic Engineering Centre's River Analysis System) and SWAT (US Department of Agriculture's Soil and Water Assessment Tool). The adaptors will enable these simulation modelling codes to be integrated in the workflow and retrieve and provide information to the other tools in the workflow. The well-known World Bank developed GAMS (General Algebraic Modeling System) optimisation engine as well as DHI's optimisation library may be added to the workflow for handling optimisation aspects, e.g. in connection with optimal water sharing at basin scale in connection with drought events;
- Tools that transform the simulation scenario output into relevant flood and drought indicators as well as multi-criteria analysis (MCA)and cost-benefit analysis (CBA) tools to score and rank the different environmental and socio-economic impacts of management scenarios and provide an informed basis for the decision making.

The project will thus provide tools for handling the full workflow process in connection with flood and drought mitigation and – equally important – establish those tools on an open platform that over time can enrich third party DSSs with innovative functionality for transboundary basin decision making.

The project implementation will be designed with sustainability in mind. Sustainability in this context means that the outputs of the project are consolidated within an institutional framework. Stakeholder consultation in the development of the DSS is a key component which will identify existing planning and response process for droughts and flood and what are the gaps. Key staff in the institutions has to be trained in the use of the DSS and the development of the DSS has to be made in a participatory manner and according to the recognized needs of the recipient. These factors will all contribute to the sustainability together with simplicity of use and a good graphical user interface

Example of tools to be developed under the project, includes:

Tool	Brief description
TDA Information Support Tool Presentation of Transboundary Diagnostic Analysis (TDA) findings for decision making	*Functionality:* Presentation of basin status, problems and issues derived from a TDS in relevant formats *Input:* Various types of information and related issues concerning geographical characteristics, social profile, basin economy and environmental governance derived from a TDA *Output:*

	Charts, Maps, Tables, Graphs displaying important relevant information from the TDA.
Statistical downscaling tool **For converting meterorological model results into input for flood and drought prediction models**	*Functionality:* Using statistical methods to establish empirical relationships between GCM-resolution climate variables and local climate *Input:* Results from a variety of Global Circulation models (GCM) *Output:* Downscaled information at an appropriate spatial and temporal scale applicable for the simulation modelling tools available in the DSS.
Dynamic downscaling Tool. For converting meterorological model results into input for flood and drought prediction models	*Functionality:* Using Regional Climate Models (RCM) to provide physically consistent results at the smaller scale and resolving smaller scale climate processes. *Input:* Results from a variety of Global Circulation models *Output:* Downscaled information at an appropriate spatial and temporal scale applicable for the simulation modelling tools available in the DSS.
Ensemble Tool Considering uncertainties in the input data and underlying modelling tool.	*Functionality:* • Processing of input modelling data and generation of the ensemble data for the modelling tools. • Control the modelling tool to produce ensemble results. Can also be used to handle multiple models in terms of using different model parameterisations • Generating probabilistic output. *Input:* Weather or other modelling data *Output:* Probabilistic simulation output data.
Model Adapters **For accessing**	*Functionality:* Adapters for third party simulation modelling tools, e.g. SWAT, HEC-

mathematical simulation models	RAS, to be integrated in the workflow process within the DSS *Input:* DSS menu wizard to register a model (simulation model with model dependent data) for execution inside the DSS *Output:* Model simulation results accessible for other components in the DSS
Indicator Tools Tools for creating appropriate flood and drought indicators based on model simulation results.	*Functionality:* Automatic estimation of flood and drought indicators based on model simulation output as well as other relevant information. An indicator is a numerical value expressing the performance of a scenario with respect to a certain goal. *Input:* Model simulation results *Output:* Indicators describing the impacts of a management scenario in a simplified and descriptive manner, e.g.: duration of flood water level above a critical level; percentage reduction in crop production etc.
Multi Criteria Analysis Tool (MCA) For developing scores and objective comparison, ranking and selection of decision making	*Functionality:* Establishing preferences, based on scores to differentiate among various solutions described by indicators *Input:* Flood and drought Indicators *Output:* Scoring and ranking of possible solutions
Cost Benefit Analysis Tools (CBA) Cost benefit analyses to compute the cost and benefit of different mitigation strategies	*Functionality:* Calculates and compare benefits and costs of chosen mitigation strategies by comparing the total expected cost of the mitigation against the total expected benefits, to evaluate if the benefits outweigh the costs, and by how much. *Input:* MCA output and other data

	Output: Socio-economic figures
Optimisation Tool, incl. GAMS For establishing optimal model simulation output based on user defined constraints	*Functionality:* This will allow users to have the model simulation output optimised with respect to specific user defined objectives. The tool will include the GAMS optimisation engine, which is a commonly used methodology in relation to large scale World Bank project. Input: User defined objectives specified as indicators and a scenario definition Output: Optimised model simulation results accessible for other components in the DSS

3.1.3 Conformity with GEF Strategies and with global processes

A number of GEF IW projects[8] have shown that the impacts of flood and droughts, and in particular of their growing unpredictability, may represent a priority transboundary concern, along with the other multiple drivers that cause depletion and degradation. Consequently, the International Waters Focal Area Strategy emphasizes the need for considering floods and droughts as a key transboundary concern in GEF-5 so that *multiple priority stresses for individual water bodies can be addressed together and collectively by States rather than by single themes or single States*. Achieving benefits attributable to water that explicitly contribute to MDGs and WSSD targets dictates that multiple stresses must be addressed and multiple uses must be balanced or at least reconciled. Concerns of droughts and floods as extreme events will therefore be incorporated into selected transboundary surface and groundwater basin IW projects through Integrated Water Resources Management (IWRM) approaches that the GEF has applied successfully in a large number of transboundary river basins.

The International Waters Focal Area Strategy for GEF-5 furthermore emphasizes the need for continued foundational capacity building, targeted research and knowledge sharing, beyond the main focus on implementation of agreed action programs. The GEF-5 Strategy specifically mentions that cross-project learning and knowledge management already piloted in the IW focal area will be even more critical in GEF-5 as new knowledge on climate and forecasting will need to be absorbed by States collaborating on transboundary water systems. Assistance with new policies based on new and timely information on fluctuating climate represents a new imperative for States and a new challenge for the GEF.

3.1.4 Global Environmental Benefits

[8] e.g.: Plata Parana Basin, Amazon Basin

It is expected that the project, by building the countries capacity to recognize and address the transboundary implications of the increased frequency and unpredictability of floods and droughts, will accrue global environmental benefits in three main fields:

(i) *Cooperation among countries sharing the resource*. The project will aim at building the capacity and providing the methodology and the tools to integrate consideration of climatic variability and change into joint fact finding and decision making processes (TDA-SAP) among riparian countries, water users, and stakeholders in general, thus facilitating the implementation of the benefit-sharing approach in balancing of water uses, preventing conflicts and improving the ability to mitigate the impacts of F&D on livelihoods and economic resource and assets.

(ii) *Ecosystem Sustainability*. The project will improve the ability of resource managers to cope with the adverse impacts of ever more frequent extreme climatic events not only on societal, but also on ecosystem sustainability. The methodology and tools developed by the project will in fact allow to factor-in the protection of biological diversity and soil functions, and of the integrity of food chains and biogeochemical cycles, which constitute the four pillars of ecosystem health.

(iii) *Water Security*. The strengthened capacity of resource managers and policy makers to recognize and address the impacts of the increased frequency and unpredictability of flood and droughts will be a key factor in determining the acceptable level of water-related risks, thus ensuring "… the reliable availability of an acceptable quantity and quality of water for health, livelihoods and production."[9]

3.1.5 Selection of Pilot basins

The tools to incorporate impacts of climatic variability and change, in particular floods and droughts into basin planning processes will be developed in a participatory process involving key stakeholders from selected transboundary basins. The stakeholder involvement will ensure that the methodologies and the enhanced tools are responding to user needs and can be used to address key water resources management issues in the particular basin. The consultation process will also identify available information and what is needed for flood and drought planning and response. In order to operate within the limits of the resource allocation and at the same time work with an in-depth, sound science and on-the-ground approach and process, it has been necessary to limit the number of basins to three, which then will act as pilot basins. The tools will thus be developed and tested in these basins, where recommendations for planning processes (including the TDA/SAP) will be drawn. .Methodologies including management tools such as zoning will be recommended and/or implemented by partners as a result of deploying the DSS in the basins.

Guidelines will be developed based on the experience achieved and such generic guidelines will allow other transboundary basins to undertake similar processes and work with the same, but context-adjusted tools.

Summaries of basin characteristics are given in Annex 1 to 5 and a summary of key characteristics of the selected pilot basins are provided in Table 1.

[9] Grey, David; Sadoff, Claudia (2007), *Sink or Swim? Water security for growth and development, Water Policy*, 9 number 6, IWA Publishing

Selection criteria for Pilot basins

Several criteria were considered when selecting basins where the methodology would be developed and field tested. They included:

- The basin is transboundary, and/or impacts a transboundary water-body (Lake, LME)
  - *This is a basic criteria (International Waters) which qualifies the project for GEF funding*
- Floods and droughts must occur and have significant impacts
  - *Floods and droughts must have significant impacts both at the transboundary level and at the local/utility level and represent serious concerns for administrators/users and other key stakeholders*
- There must be at least a large urban area in the basin
  - *A large urban area where floods can influence intake areas, pollution levels and where droughts can cause severe water stresses will help illustrating the usefulness of the tools and methodologies*
- Basin authorities, key water users and stakeholders must be supporting the program
  - *Stakeholders must have a strong interest in the program and the expected outcomes in terms of solutions to flood and drought issues. The interest could for instance materialize as co-funding of the program*
- The basin must be within the GEF interest sphere
  - *The pilot basins have received GEF IW support and/or there are possibilities for synergies between projects and programs*
- Presence of potential partner organizations in the basins
  - *Basins where both DHI and IWA have experienced a positive will of cooperation in other projects / programs would be preferred for pragmatic reasons and for reasons of efficiency.*

  In addition to the above criteria it was considered desirable that the basins show a range of other characteristics that would allow an assessment of the performance of the methodology under different conditions. Such variations would relate to:
- Climate zone and physiography
- Level of development (for instance indicated by the Human Development Index, HDI, reflecting health, knowledge and income)
- Level of development within Integrated Water Resources Management, reflecting for instance soundness of the enabling environment, strength of the institutional environment and use of water resources management tools.

Screening process

The process took its starting point in the 263 transboundary basins in the Transboundary Freshwater Dispute Database. The treaties refer to formal, government-based institutional arrangements, specifically designed for international river basins. Subtracting the 40 North American treaties, the effective number of transboundary treaties comes to 223. The next step was to investigate these basins further. This resulted in an identification of 58 basin organizations, where "basin organization" refers to an existing entity with a physical or virtual address, which can be contacted.[10]

[10] Up to this point the screening is based on the screening described in "Report on IWRM in Transboundary Basins" UNEP-DHI Centre for Water and Environment, 2011

A number of criteria were taken into consideration and the criteria above were finally adopted. Through the application of these criteria w the number of pilot potential basins went down from 58 to 23. See table below.

Selection according to criteria in the table heading

	Transboundary institution existing	Floods, Droughts or both occur in basin	Large urban area exists in basin	GEF Interest sphere (not in OECD - not in North America)
Africa				
Congo	Yes	Yes	Yes	Yes
Lake Victoria	Yes	Yes	Yes	Yes
Limpopo	Yes	Yes	Yes	Yes
Niger	Yes	Yes	Yes	Yes
Nile	Yes	Yes	Yes	Yes
Orange	Yes	Yes	Yes	Yes
Senegal	Yes	Yes	Yes	Yes
Volta	Yes	Yes	Yes	Yes
Zambezi	Yes	Yes	Yes	Yes
Asia				
Amur	Yes	Yes	Yes	Yes
Aral Sea	Yes	Yes	Yes	Yes
Har Us Nur	Yes	Yes	Yes	Yes
Ili	Yes	Yes	Yes	Yes
Jordan	Yes	Yes	Yes	Yes
Mekong	Yes	Yes	Yes	Yes
Ob	Yes	Yes	Yes	Yes
Pu Lun T'o	Yes	Yes	Yes	Yes
Tigris	Yes	Yes	Yes	Yes
Europe				
Dnieper	Yes	Yes	Yes	Yes
Volga	Yes	Yes	Yes	Yes
South & Latin America				
Amazon	Yes	Yes	Yes	Yes
La Plata	Yes	Yes	Yes	Yes
Lempa	Yes	Yes	Yes	Yes

Following this selection, these basins were discussed also in terms of the feasibility of engaging stakeholders in a meaningful way, considering the resources of the project. The additional criteria above were also brought into the process. The result of the discussion was the selection of three basins:

- Volta Basin
- Lake Victoria Basin
- Chao Phraya

The selection of these three pilot basins was undertaken by consulting with stakeholders in each basin to gain an understanding of the relevance of the flood and drought methodology in each area.

This included assessing existing involvement in GEF including commitment to TDA and SAP processes, flood and drought impact, whether there were major urban areas and the existence of a water safety planning process. Other considerations included the presence of the executing agencies and whether end users (basin organizations and water utilities) had an interest in being a pilot basin. Finally, it was determined the level of resources needed for successful project implementation in pilot basins. This analysis determined three pilot basins supported by at least one learning basin would provide the project with sufficient information and testing to develop the generic flood and drought methodology. Brief basin profiles and a summary table are given below.

Volta
The Volta Basin was selected as it represents a basin where there is irregular flooding and drought, in a drought prone region. The catchment is developing with increased urbanization, expansion of agriculture and investment in infrastructure such as hydropower. The basin has an ongoing GEF project on "Addressing Trans-boundary Concerns in the Volta River Basin and its Downstream Coastal Area" which is a regional initiative designed to facilitate the integrated management, sustainable development and protection of natural resources of the Volta River Basin.

The Volta Basin Authority (VBA) has recently established the Volta Basin Observatory, which monitors the status and trends of the water resources and the environment of the basin. The information and tools to be generated by the Observatory will assist the decision makers in taking well documented decisions. Consequently, the GEF Floods and Droughts project serves to strengthen ongoing initiatives related to improved water resource tools and DSS.

Lake Victoria
The Lake Victoria Basin is prone to floods in the low-lying areas of the basin during the rainy season where water reaches peak levels and rivers overflow their banks. This affects both water quantity and quality due to increased sediment loading. The basin was selected because it is a major lake basin and is part of the larger Nile Basin. The project will actively collaborate with the Nile Basin Initiative as a DSS has been developed for the Nile basin to guide water resource planning and investment decisions. The pilot basin will provide an opportunity to study both floods and droughts in the basins draining to the lake and the lake level fluctuations. GEF has invested significantly in foundational projects through the World Bank as an implementing agency. The umbrella institution in the catchment, the Lake Victoria Basin Commission has expressed a strong interest in the methodology considering that users, from the Commission itself to utilities, industries etc., need to make the best use of available data in decision making. Currently, LVBC has a database for hydrological information, and is developing a water resource information management system, which will eventually have real time monitoring of lake levels and quality in the future. This development is supported by DHI. An approach, such as the one to be developed by the project, is however needed to interpret and use information on floods and droughts in basin and water safety planning and investments.

The Nile Basin was not chosen as a pilot basin because the complexity of the Nile basin and its actors coupled with the resources available would not result in effective implementation of the project within the basin. In addition, no TDA/SAP have been prepared for the larger Nile system.

Chao Phraya
The Chao Phraya is an exclusively national basin (Thailand) draining into, and impacting a transboundary LME (the South China Sea, through the Gulf of Thailand) which is the subject of various UNEP, UNDP and WB interventions supported by the GEF. The basin was selected for a variety of reasons, including the recognition that it is in a rapidly developing region and is an

important economic hub at the global level. Floods are a regular feature of the Chao Phraya basin and cause significant economic losses, therefore investment in tools to manage floods (and droughts) are a priority. Consequently, there is increased investment in the basin to improve flood management, which includes development of decision support systems for several sub-catchments. As the water resources law is being drafted, the water budget system is becoming more holistic, and as IWRM is being introduced, this is an appropriate time to be involved in the basin. In terms of end users, water utilities are now in the process of developing water safety planning in the basin; therefore it would be possible to work with these users to actively incorporate outputs of DSS from WSPs. Overall, there is a strong incentive to use DSS and develop approaches to improving flood and drought management.

Additional Basins -The project selected pilot basins for directly testing of the methodology and tools. These include the Lake Victoria Basin Volta Basin and Chao Phraya. During the project preparation process there have been indications that other transboundary basins than those selected would like to engage in the process and exchange experiences as the process develops. In order to follow the principle of non-exclusivity and in order to give benefit to additional basins the project will engage interested basins as far as possible within the resources allocated and without compromising the intended quality of the project.

Such an additional basin will be termed learning basin. The learning can be two-ways. The project can no doubt learn from certain issues that have been addressed in the basin and the methodologies and tools used. On the other hand, certain innovative methods and tools will emerge from the project and as they are in the public domain they can be applied by the agencies in the learning basin.

One such learning basin is the Danube, which has shown interest to such a degree that it has decided contribute with co-finance. The Nile Basin also has considerable experiences with related DSS tools and management methodologies, during the project inception period it will also be approached as a possible learning basin.

The engagement with learning basins will be to identify main water management issues and use these as a starting point for discussion. Transboundary cooperation has been on-going for a long time (in some cases with the support of GEF) and this provides an opportunity to take stock of how the basin is managing flood events, what are the gaps and what can be developed in the future. Specifically, what is the support system needed to improve the decision making process? The outputs of these discussions would be used in the development of the methodology.

Danube. The Danube Basin was considered a suitable learning basin as it is institutionally mature and has had to deal with the impacts of serious floods and droughts. In addition, there has been significant GEF funding over time on transboundary management. It is essential to gather the knowledge and experiences from the Danube to incorporate into tools being developed to deal with floods and droughts. This ensures that DSS and the associated tools are not being reinvented. At the same time, the pilot basins will have the opportunity to actively learn and exchange information with users in the basin on how they practically use information from DSS in planning and implementation of water management.

The project will use the inception phase to engage additional learning basins where experience on methodology can be exchanged. As a background for these exchanges these basins will use a stakeholder consultation process to determine what issues need to be addressed around flood and

drought management. A first opportunity to establish mutual contact will be the IW Conference in Barbados in October 2013.

Summary of basin characteristics

Basin	GEF involvement	Transboundary institution	Geographical location	Nos. of countries in basin	Flood and drought impacts	Major urban area	Existing water safety plans
Volta	2006 - date	Volta Basin Authority	West Africa	6	Serious – irregular flooding and drought	Ouagadougou	Under development
Chao Praya	Not earlier	None	South East Asia	1	Extremely serious	Bangkok	Under development
Lake Victoria	1997 - date	Lake Victoria Basin Commission	East Africa	5	Serious	Kampala, Mwanza and Kisumu	Yes

3.2. Project goal and objective

3.2.1 Project Goal

The project aims at contributing to the global efforts being made to maintain acceptable levels of societal and ecosystem sustainability vis-a-vis growing climatic uncertainty and unpredictability.

3.2.2 Project Objective

The objective of the project is to improve the ability of land, water and urban area managers operating in transboundary river basins to recognize and address, as part of the TDA-SAP, IWRM plans and water safety plans processes, the implications of the increased frequency, magnitude and unpredictability of flood and drought events (F&D).

3.3. Project Components and Expected Results

Component 1: Development of Methodology
(GEF $1,691,976)

Outcome 1.1: A methodology with tools aimed at increasing understanding of F&D dynamics and impacts at transboundary and national levels and including enhancement of commonly used decision support systems, fully developed jointly with pilot basins stakeholders.

Output 1.1.1: (GEF $1,591,976) A methodology with tools adopting a basin approach, including enhancements for decision support systems, that would allow the integration of F&D consideration into (i) the TDA-SAP GEF IW or equivalent processes, and (ii) IWRM plans and Water Safety plans.

Activities

1.1.1.1: **Develop and integrate F&D components for DSS systems - DHI**

- Describe impacts/issues/consequences of floods and droughts in a transboundary basin context
- Identify F&D indices the means by which these can be monitored or predicted, and the data and analytical tools required;
- Outline a DSS, which can accommodate F&D situations considering technical, economic and environmental aspects (including risks and consequences);
- Prepare a description of overall methodology for application of the F&D DSS components for use at stakeholder consultations

1.1.1.2 - Stakeholder consultations in each pilot basin (3) and learning basin (at least 1) to provide awareness of the project and provide further input and verify the methodology so it is relevant for end users - IWA with DHI support

- Identify 15-30 participants to participate in each stakeholder consultation, which will be a mix of focus groups and key informant interviews
- Organize meetings in each pilot basin with relevant stakeholders, if possible in conjunction with planned events (e.g. IWA conferences). There will be an emphasis on identifying existing flood and drought planning and response processes to identify gaps that the DSS can address.
- During stakeholder consultations identify impacts on vulnerable groups affected by water related shocks. This will be further expanded in Activity 3.1.1.2

- Summarize discussions in stakeholders consultations into a report which provide end user verification and additional guidance to floods and drought methodology

1.1.1.3 - Develop and quality test DSS codes which integrates flood and drought management decisions in water resources management - DHI

- Prepare a software development plan
- Prepare a detailed design of F&D DSS components

1.1.1.4 - Estimate F&D impact and climate resilience - DHI

- Describe approach for estimating F&D impacts from changes in climate change including current best practices for estimating key climate parameters to be used in decision making;
- Collect and analyze empirical evidence of changes in floods and droughts based on changes in climatic parameters to the three pilot basins
- Inventory of previous and existing initiatives related to climate change and taking contact to those that may be relevant for cooperation/lessons learnt including World Bank supported initiatives such as WB GAMS (ref. section 3.1.2)
- Develop downscaling DSS components for global climate change impacts in F&D context basins

1.1.1.5 – Develop a methodology to apply DSSs in TDA/SAP, IWRM and WSP – DHI (with IWA input)

- Demonstrate the use of DSS with representatives from basin organizations, urban water utilities and relevant industries to resolve typical hot-spot issues in TDA/SAP, IWRM and WSP processes
- Test applicability in model transboundary basin
- Consolidate stakeholder input to methodology to apply DSS
- Prepare outline manuals and guidance

Output 1.1.2: (GEF $100,000) Guidance materials for the application of the Methodology with DSS tools

Activities

1.1.2.1 - Prepare consolidated manuals and guidance for application – DHI with IWA input

- Accumulate experience from applications
- Prepare guidance material based on experience of use. Material will include, system manuals, approaches, methodologies and demos. Methodologies refer to management tools and approaches which could be recommended and/or implemented by partners as a result of deploying the DSS in the basins.
- Test format and usefulness of guidance material on a number of selected trainees

Component 2: Application in Pilot Basins (GEF $949,943)

Outcome 2.1: Application of the methodology with DSS tools in the three pilot basins enables the integration of F&D consideration into the IWRM, TDA-SAP, Water Safety and other planning processes.

Output 2.1.1: (GEF $949,943) Strategic recommendations for inclusion of flood and droughts consideration in IWRM, TDA, Water-Safety and other basin land and water planning tools in the 3 selected pilot basins.

Activities

2.1.1.1 – Establish working environment for application of methodology with DSS tools in pilot basins – DHI with IWA input

- Plan application in pilot basins together with project partners
- Transboundary basin and national water managers who are specifically involved in responding to water related risks provide guidance to identify and select specific areas for application. Involvement of relevant civil society to ensure that areas selected take into account vulnerable areas impacted by floods and droughts. The relevant civil society representatives will be identified during the stakeholder consultations (Activity 1.1.1.2)

2.1.1.2 - Apply F&D Components in a DSS for TDA/SAP, IWRM and other planning processes- DHI

- Demonstrate the potential of an enhanced DSS in specific cases in three pilot basins,
- In cooperation with transboundary basins and national water managers involved in activity 2.1.1.1 demonstrate the applicability and usefulness of the DSS in the in GEF IW projects and IWRM plans in the three pilot basins. Simultaneously provide training on the application of the flood and drought DSS to end users including basin officials (transboundary and national), and urban managers from water utilities and industry.

2.1.1.3 – Recommend policy and strategy for F&D in consultation with stakeholders – DHI with IWA support

- With transboundary basins and national water managers involved in activities 2.1.1.1 and 2.1.1.2, prepare strategic recommendations for inclusion of flood and droughts consideration in IWRM, TDA/SAP and other basin-wide land and water plans in selected basins
- Develop documentation of the process to provide basin specific guidance on how to use information from the floods and drought components of a DSS in developing recommendations for planning.

The proposed basins were selected, in part, because their TDAs and SAPs or other such planning/prioritization documents, identified flooding and/or droughts as pervasive problems and the basins were already committed to exploring tools to assist in understanding and managing such events. In this way, the project addresses some identified SAP actions and contributes to SAP implementation. However, it is beyond the scope of this project to deliver the updated TDAs, SAPs, IWRM plans themselves, though partners are encouraged to update these planning tools periodically and the data from this project will be available to inform these processes. Time and resources in Component 4 are devoted to writing up the project experiences, reflecting on lessons, dissemination and exchange and it is hoped that through these processes, the pilot and learning basins will be better prepared to refine TDA, SAP and IWRM processes in the future, but also other basins will be exposed to these experiences and may take them up as a part of their foundational GEF projects or linked to their TDA, SAP and/or IWRM updates.

Component 3: Validation and testing at local level (GEF $599,256)

Outcome 3.1: Uptake of the methodology with DSS tools at lower administrative levels within the 3 pilot basins enables water suppliers and regulators, (agro) industries and urban area managers to consider options for increased resilience and preparedness to F&D within broader basin context with an emphasis on vulnerable groups affected by water related shocks.

Output 3.1.1: (GEF $212,000) Downscaled methodology with DSS tools for integration in at least 3 urban areas with urban and (agro)industrial water users perspectives and realities in floods and droughts planning at basin level.
Lead Agency: IWA & DHI

Activities

3.1.1.1 - Cooperate with utilities to identify test areas – IWA with DHI support

- With guidance from basin representatives and urban water managers, screen and select at least 3 water utilities (one in each pilot basin) with motivation and knowledge to participate as test cases
- Identify, together with selected water utilities, a test area in each of the pilot basins, where F&D interferes with the water safety in a significant manner. Involvement of relevant civil society to ensure that the test areas selected take into account vulnerable localities impacted by floods and droughts.

3.1.1.2 – Assessment of the gender and social dimensions in F&D management

- Consultations and stakeholder involvement in flood prone areas within pilot basins
- Identify water relevant gender indicators being adopted and monitored by countries, if any.
- Identify impacts of droughts on men and women/girls, including hygiene, and analyze options for diversified livelihood support for women during droughts.

3.1.1.3 – Develop downscaled methodology with DSS tools for incorporating F&D into planning processes in collaboration with key end users in pilot basins – DHI with IWA support

- Adapt the DSS/F&D methodology to cover the size of the test areas
- Investigate the need for urban drainage models

3.1.1.4 - Support application of methodology with DSS tools in at least 3 urban areas in the pilot basins through involving utilities and industry end users – IWA with DHI support

- Apply a suitable model to test at least one urban area/catchment within each of the 3 pilot basins with the ultimate purpose of improving the resilience and preparedness through appropriate planning and implementation of mitigating measures. Simultaneously provide training on application of the downscaled methodology during implementation with water utility and industry representatives.

Output 3.1.2: (GEF $387,256) Recommendations for updated plans, including investments, for utility water safety and, urban drainage and socio-economic urban areas vulnerable to F&D incorporating basin level constraints and outlooks.

Activities

3.1.2.1 - Work with utilities to use recommendations derived from DSS/F&D assessments to provide input into plans– IWA with DHI support

- Establish critical factors (e.g. water levels) for water safety and urban drainage at the selected test areas/catchments and assess impacts, risks and frequencies.
- Establish factors that can improve resilience and provide recommendations to update water safety plans accordingly

3.1.2.2 - Document the design and implementation process of F&D methodology in pilot basins to be communicated to a wide range of stakeholders - IWA

- Develop communication strategy to collect and use information on application of F&D methodology in the 3 pilot basins and urban areas
- . This includes management tools and methodologies which could be recommended and/or implemented by partners as a result of deploying the DSS in the basins
- Collect and collate information from the pilot basins through various media - video, blogs, interviews, focus groups, etc.

Component 4: Capacity building and dissemination (GEF $658,406)

Outcome 4.1: Experience and know how gained through the project is made available within the GEF system and beyond.

Output 4.1.1: (GEF $328,406) Learning package including technical specifications and training materials for the application of the new methodology with DSS tools is tested in 2-3 trainings with basin officials, utility and industry management and operational staff, and representatives from civil society with 15-30 people per training.

Activities

4.1.1.1 - Prepare technical specs, manuals, guidance and training materials – IWA with DHI support

- Identify potential basin, water utility and industry users' levels of knowledge and establish their need for knowledge and training. This includes those involved in the development of the DSS tool and additional users who would apply the tool and use the outputs.
- Establish and consult with international pool of experts to define and review guideline materials needed for incorporating F&D methodology into planning processes
- Prepare technical specifications and user manuals enabling professional level staff to apply the methodology and models and prepare water safety plans

4.1.1.2 – Prepare training module on application of F&D methodological approach from basin to end user for inclusion in existing training courses – IWA

- Development of module that contains information on F&D methodological approach in catchment and end user context into WSP training
- Testing of module in 2-3 existing trainings on WSP to build the capacity of end users (basin representatives, water utility and industry users) in understanding the DSS application and use of the results in planning (e.g. water safety planning). Training will have between 15-30 participants.

Outcome 4.2: Global dialogue on water security and climate resilience is enriched by the dissemination of and awareness raising on project outcomes.

Output 4.2.1: (GEF $71,000) 2-3 Experience Notes and other documents and audio-visual materials produced for IW LEARN dissemination mechanisms and website.

Activities

4.2.1.1 – Audiovisuals, documents and other materials for global dissemination with an emphasis on IW LEARN (67,000 USD – 1.6% of total grant)- IWA

- Analyze IW LEARN mechanisms and their requirements to materials in order to streamline it with the existing materials and to make it accessible on a global scale
- Prepare and adjust materials on the methodology and the application to meet the requirements of IW LEARN
- Identify other dissemination channels in order to reach out broadly including development of project website
- Participation in IW LEARN events

Output 4.2.2: (GEF $259,000) Communication materials (4-5) developed and disseminated through participation at major water events: WWF, Water Week, GEF IWC 8/9, and IWA Conferences.

Activities

4.2.2.1 - Prepare brochures, leaflets, CDs and materials suitable for water events – IWA with DHI input

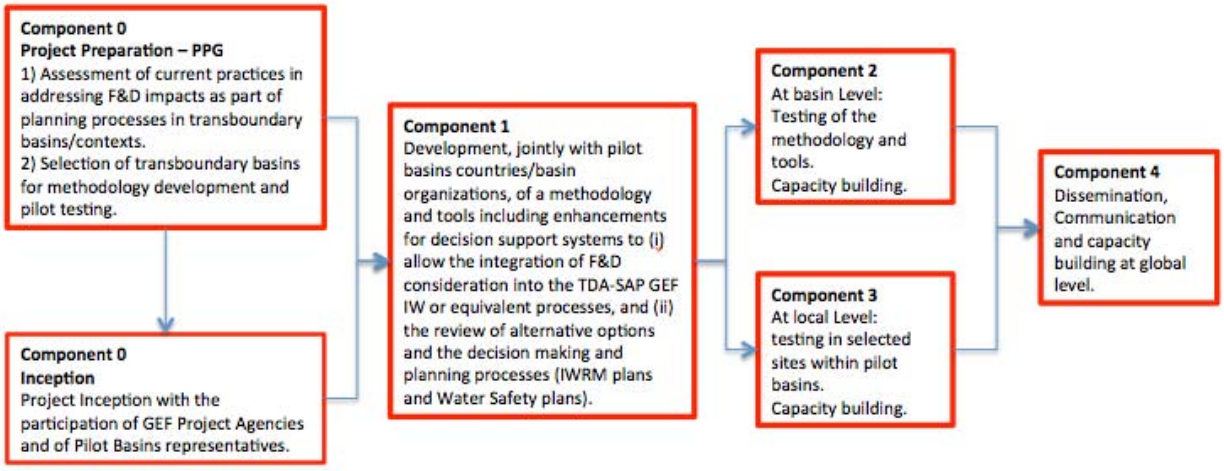
- Identify water events scheduled for the near future and where the methodology would be a relevant topic for presentation
- Prepare presentation material tailor-made to water events (pamphlets, CDs, posters etc)

4.2.2.2 - Organization of and participation in international conferences and workshops for the dissemination of methodological approaches and technical solutions across networks - IWA

- Organize and facilitate of workshops at key events including: IWA World Water Congress (Lisbon (Portugal), September 2014 // Brisbane (Australia), September 2016), IWA Development Congress, and IWA Conference on Water, Climate and Energy (Cape town, February 2014).
- Support key stakeholders to attend and present at international events

3.4. Intervention logic and key assumptions

The intervention logic, and the overall project design are summarized in the figure below.



The assumptions on which the design is based on are listed in Appendix 4, Logical Framework.

3.5. Risk analysis and risk management measures

Risk	Likelihood	Mitigation Measures
The success of the project will rely upon a variety of agencies and partners working together, which will increase the complexity of the implementation and may impact the final results.	Medium	During the project preparation phase particular emphasis will be placed on definition of roles and responsibilities, as well as accountability for joint management and results.
Basins do not contribute information to the DSSs	Low	Pilot basins were screened and accepted based on having a certain amount of relevant information and data already in place and freely available to collaborators
It can be very difficult to translate areas of common interest with the private sector into tangible results.	Medium	Having a separate component that will focus solely on identifying lessons learned and possibilities from previous experience will help to ameliorate a portion of the risk. Collaboration with the private sector is desirable but not necessarily a fundamental requirement for the success of the project.

Not all GEF IW projects are willing to be assessed and react to recommendations for change.	Low	Project stakeholders are officially encouraged to utilize this project in order to improve the outcomes of their own.
Even though decision support is developed, it is not used by the target stakeholders, either because they are not aware of them or are unable to access them.	Medium	Efforts will be made to learn from previous experiences, and to understand the needs of the users, with a view to developing not only a user-friendly format, but also training and other forms of dissemination.
The project establishes a 'push-approach' to the use of DSS rather then a genuine approach to engage with stakeholders and respond to their demands, resolving their immediate needs and producing tangible benefits in a reasonable timeframe.	Medium	The project design is thoroughly reviewed and tested with key stakeholders and beneficiaries from the start.
The tools are not broadly useful across the GEF Portfolio	Low-Medium	The tools will be designed taking into account the participating basins needs. While these may not be exactly the same across the whole GEF portfolio, they should be indicative and representative. A number of forums (IWC meetings and side events and other international fora) will also be used to canvas stakeholders needs and adapt the DSS tool accordingly.

3.6. Consistency with national priorities or plans

This International Waters project, developed at the specific request of GEF Secretariat, aims at providing all GEF client countries with tools and a methodology to integrate the consideration of the impacts of increased climate variability and change both into transboundary waters cooperation schemes and into national policies and plans. In fact, the globally valid methodology and tools developed by the project will be tested in three pilot basins involving a total of 12 countries and the piloting and testing of the floods and droughts tools and recommendation of methodologies will support both national and regional climate change adaptation and water management processes in these countries. For example, the six riparian countries of the Volta Basin are all implementing modern IWRM policies which must consider the impacts of extreme events on water management practices. Also, the Volta Basin Authority has facilitated a process of developing a Transboundary Diagnostic Analysis and a Strategic Action Programme, which both highlight the importance of understanding and preparing for extreme climate events in the context of the sound management of basin water resources. Pilot testing the DSS tools in the Volta Basin, and the recommendations and actions that result from the pilot testing, will support both the six riparian countries and the Volta Basin Authority in strengthening both IWRM and adaptation in the water sector. Similarly, for the Chao Phraya River Basin, the UN Partnership Assistance Framework (UNPAF) highlights

the relationship between natural resources management and the "increasing frequency and intensity of natural disasters". The piloting of the project tools and methodology will contribute to multiple outputs in the UNPAF, including: "increased access to holistic approaches for disaster risk reduction," "enhanced capacities for sustainable water management," "support for evidenced based planning, policy- and decision-making."

3.7. Incremental cost reasoning

UNEP's current Program of Work includes significant support both to the development and application of IWRM and to building resilience to the adverse environmental impacts, including floods and droughts. Under the Sub-Program on Ecosystem Management [#311], UNEP supports countries to identify and develop and test tools to strengthen ecosystems functioning for water regulation and purification services, particularly in developing countries. The tools developed include policy planning; assessment/identification of drivers – in particular climate variability. Under the Sub-Program for Climate change [#111], UNEP supports countries in building climate resilience of vulnerable human societies, ecosystems and economies through increased understanding of multi-stressor interactions and the mobilization of knowledge, capacities and integrated assessment results to support adaptation policy setting, planning and practices. *The proposed project will build upon and expand UNEP's existing work by developing synergies between the two areas*.

UNEP-DHI Centre and its host institution, DHI (a not-for-profit foundation), have a wealth of experience in working with IWRM policy and implementation in transboundary settings. In recent years DHI has worked on both identifying and seeking to address the need for systems that support decision-making processes of water managers in river basins. The resulting Decision Support Systems (DSS) combine databases, models, GIS and web technologies with configurable decision logics. This information is processed in such a way that it allows water managers to produce various scenarios that can allow them to make informed decisions and provide answers to important management questions. DHI is currently involved in sizeable test and implementation projects using its DSS in the Nile Basin (all countries), Egypt, Kenya, India, Southern Africa and Australia. Depending on what is required and the range of models and tools applied, the analyses produced by the DSS can range from very simple to highly complex, and can be used, for example, for the feasibility testing, planning and design of various water dependent projects within a basin. To date however, the DSSs developed by DHI have not been designed to explicitly take the more extreme climate events (floods and droughts) into consideration. *The project will allow building this "skills" into more commonly used DSS systems by developing open access modules and adaptors*.

IWA and partners have developed an approach based on Water Safety Plans (WSP) to enhance water security for cities, utilities and industries. Water Safety Plans help cities and industries to determine issues within their boundaries and circle of influence as well as those in the wider river basin context. As such it is increasingly seen as a viable approach to engage with a wider set of stakeholders influencing, for example, water intake, groundwater levels, water quality standards, discharge permit criteria etc. In many ways, a Water Safety Plan approach complements wider basin planning and use of basin wide tools in that it provides a more in depth engagement with key stakeholders and their legitimate concerns about wider water planning and use. A key outcome of this approach is arriving at an optimization of water use at the industrial plant / city level. This forms a crucial step for engaging constructively in a wider basin optimization with a broader set of stakeholders and building system resilience in the face of increasing floods and droughts. With urbanization increasing in most basins, the need to better incorporate municipal water concerns into basin-level planning processes becomes paramount.

IWA has developed a Water Safety Planning manual, which is a step-by step risk management approach for drinking water suppliers. To accompany the manual, IWA has developed an online resource of tools and case studies (www.wsportal.org) and a training package, which includes a trainer's handbook, trainee's workbook and set of standardised PowerPoint slides. An additional resource also developed with WHO is the WSP quality assurance tool which can be used for self-assessment and outside evaluation. Furthermore, IWA through funding from USEPA have developed the Drinking Water Quality Knowledge and Advisory Service, which is a helpdesk that provides in-depth advisory support to those involved in urban drinking water management in low and middle income countries, particularly involved in Water Safety Planning.

The WSP approach however lacks strategic engagement with the catchment where the planning is taking place, and consequently floods and droughts are not well integrated into the planning process. The GEF project provides an opportunity to build on the WSP approach and address the demand for wider integration of impacts of floods and droughts from the catchment where utilities are located. The methodology developed through the GEF project can be an integral part of training and implementation of WSPs.

There are a number of opportunities where this can have immediate effect. IWA and USEPA are coordinating a five-year programme to improve the quality of drinking water in 10 East African countries through the implementation of Water Safety Plans (WSPs). One of the components of the programme is the development of Water Operator Partnerships (WOPs) whereby water operators provide peer assistance in the development and implementation of WSPs. For example, a WOP is currently being developed around Lake Victoria including National Water and Sewerage Cooperation (NWSC, Kampala), NWSC (Kampala), Mwanza Urban Water and Sanitation Authority (MWAUWASA, Mwanza) and Kisumu Water and Sewerage Company (KIWASCO).

The WSP approach provides water operators with a planning tool to evaluate the risks associated with raw water quality and a point of departure for working more closely with catchment authorities and other key stakeholders to prioritise actions related to mitigating and managing such risks. Gaining a better understanding of the links between catchment management and drinking water quality together with improved stakeholder cooperation, can go some way to improving a water operators confidence that they are consistently providing safe drinking water to consumers.

3.8. Sustainability

The project will address issues of sustainability at two distinct levels.

- At pilot basin level, by developing - *jointly with the countries sharing the three project transboundary basins* - the methodology and the open access software tools that will enable the countries to improve their ability to cope with the impacts of F&D. This joint development will build country ownership of the methodology, create the capacity for application and implementation of the F&D methodology into planning, and foster the likely continuing utilization of the methodology at the regional level in the pilot areas. Capacity development will provide opportunities for both men and women to develop skills in applying and using the outputs of the methodology.
- At the global level, through the broad range of awareness raising and dissemination activities that will be part of the project itself, and through the mainstreaming of the methodology and tools in the activities of the GEF, the Implementing Agency and the two Executing Agencies.

3.9. Replication

The objective of the project is the development of a field-tested methodology to allow consideration of increased frequency and unpredictability of extreme climatic events, in particular floods and droughts, at various levels in the context of river basin planning. As such, replication of the project is not a primary target, with the possible exception of the replication, in similar methodological efforts, of the participatory approach applied in the development and testing of the methodology.

The results of the project however, i.e.: the new methodology together with the tools allowing "climate" enhancement of existing DSSs, if proven cost effective, will have instead great replication potential and the project includes in fact dissemination and awareness raising activities aimed exactly at fostering broad application, or "replication", of the new methodology to GEF IW projects and beyond.

3.10 Public awareness, communications and mainstreaming strategy

Communications is an integral part of the whole project and is evident in each component. An overall communications strategy will be developed at the project inception and implemented, built around multi-media communications products that will target different stakeholder groups from basin to local level. There will also be a calendar of events to engage wider stakeholders around the information being developed over the duration of the project. The strategy will incorporate dissemination to the media in key national and regional locations, as well as international media, to promote better informed public discourse on planning for flood and drought events.

Initial communications will include setting up a project website, relevant social media and developing a project brochure or flyer to ensure that the project provides a consistent message of what it aims to achieve. The agenda and outputs of stakeholder meetings will be readily available on the website, and the project will aim to ensure that this is in a variety of accessible forms (such as video or blogs).

The process of developing the generic methodology to apply decision support systems to various types of water planning will be clearly documented so that the information can be developed into user manuals and guidance. In component 2 and 3 of the project the process of applying the methodology at the basin and local level will be documented through various media such as video, blogs, interviews, focus groups, etc.

Component 4 has a strong emphasis on dissemination of the project outputs. This includes the development of training material that will contain information on the F&D methodological approach in catchment and the end user context. This can be specifically applied to water safety planning training as this is an ongoing activity in many of the pilot basins. Under output 4.2.1, the focus is on the IW LEARN dissemination mechanism. The project will actively interact and provide information to IW LEARN to enable sharing and application of the project outputs to other GEF projects and beyond. More than 1% of the overall grant (67,000 USD) is designated for IW: Learn activities.

There will also be a wider dissemination and communication approach through targeting of key water events such as IWA World Water Congress (Lisbon (Portugal), September 2014 // Brisbane (Australia), September 2016), IWA Development Congress (Nairobi (Kenya), October 2013), World Water Week (Aug each year), IWA Conference on Water, Climate and Energy (Mexico, March 2014), the World Water Forum (March 2015). There are also numerous IWA technical specialist groups' conferences which can be targeted, such as the Hydroinformatics conference in August 2014 or the Watershed and River Basin Management conference in September 2014. The types of approaches at such events can focus on workshops where key stakeholders are involved to strengthen ownership of the project. These also

provide an opportunity to develop partnerships and leverage the project such that the outputs are used beyond the pilot and learning basins.

3.11 Environmental and social safeguards

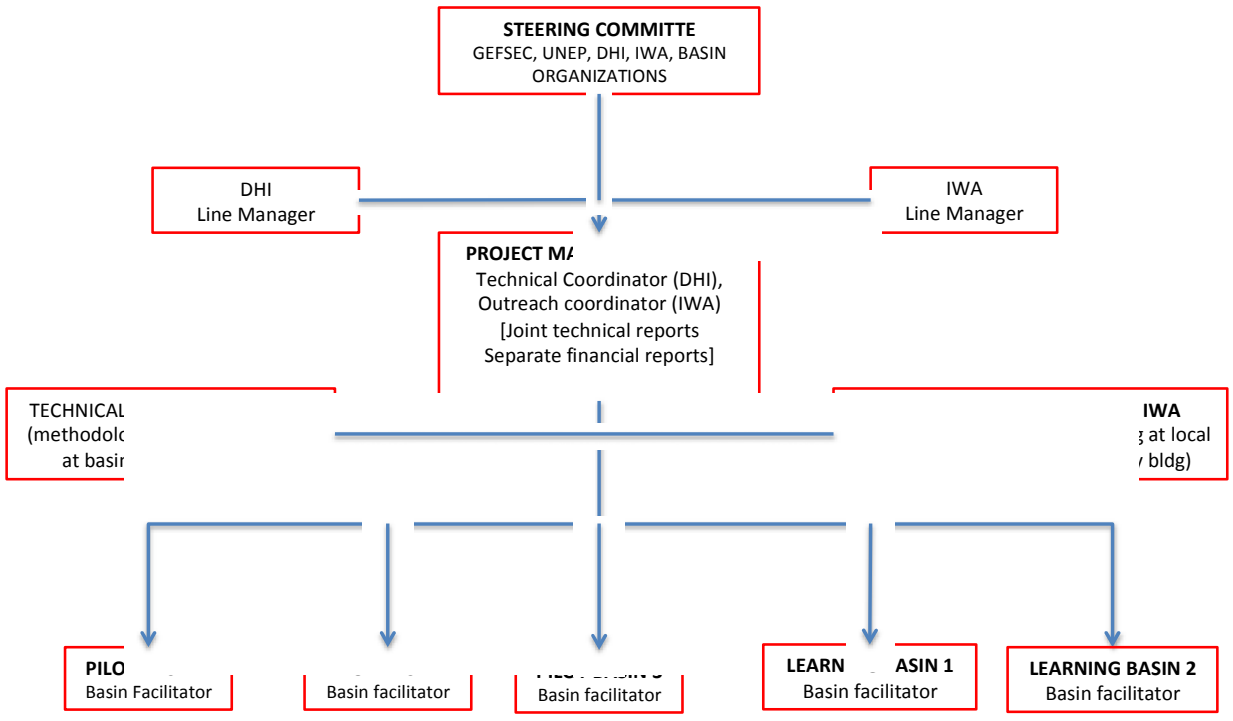
The implementing agency – UNEP, integrates the UN's environmental and social principles into all its programs and activities, so environmental and social safeguards are seamlessly incorporated into all of the agency's actions and procedures. A detailed Environmental and Social safeguards checklist has been completed for this project at the PIF submission, and now again at the time of CEO endorsement (see Annex M of the CEO endorsement template). The Environmental and Social safeguards checklist will, in addition, be reviewed at the inception workshop, and through the mid-term and terminal evaluation processes.

The environmental and social safeguards exercise has noted that there are no direct positive or negative environmental or social impacts expected as a result of this project developing tools and recommendations for methodologies for incorporating flood and drought management into broader IWRM processes. The exercise further noted that the methodology will be piloted in three specific basins, the Volta, Victoria and Chao Phraya Basins, resulting in recommendations for managing and mitigating flood and drought impacts. It is possible that the implementation of these recommendations (which is beyond the scope of the current project intervention and finance) could possibly result in positive or negative environmental and/or social impacts. Therefore it will be important to again formally review environmental and social safeguards at the time of implementing any management recommendations.

Equally, with considerations of social impacts, the Project's activities are explicitly geared towards openness, inclusion, gender sensitivity and respect for cultural diversity. The Project includes regional and national training courses. The Project will actively encourage countries to strive for gender balance and the inclusion of all social groups in training courses, among all other project activities. Inception activities in particular will delve deeper into stakeholder analysis at the basin level to ensure balanced participation.

SECTION 4: INSTITUTIONAL FRAMEWORK AND IMPLEMENTATION ARRANGEMENTS

The Institutional Framework and Implementation Arrangements are shown schematically in the figure below. The Implementing agency of the Project is UNEP, while the Danish Hydrologic Institute – DHI, and the International Water Association – IWA are joint executing partners. Upon CEO endorsement of the project, UNEP will prepare a single, three-party Project Cooperation Agreement (PCA) between itself and DHI + IWA for delivery of the project. The PCA will outline the roles and responsibilities of the each of the agencies (UNEP, DHI, IWA) during project implementation.



Project Steering Committee

The **Steering Committee (SC)** will be composed of representatives of the funding partners and of the implementing and executing agencies (GEF Secretariat, UNEP, DHI, IWA), and of the pilot basin organizations[11]. The SC will set its own operational procedures and approve its own Terms of Reference. It will meet at least once a year and thereafter as frequently as the SC itself deems necessary. The SC will

[11] Additional representatives can be considered as well, such as key utilities with a primary interest in the project.

review the project budget and work programs and provides feedback and policy guidance to the PMU on such matters. Funding for SC business will be covered by the project.

The Project Steering Committee will be responsible for providing general oversight of the execution of the Project and will ensure that all inputs and activities agreed upon in the project document are adequately prepared and implemented. In particular, it will:

- Provide overall guidance to the Project Management Unit in the execution of the project;
- Ensure that all project activities and outputs are in accordance with the project document;
- Identify, agree and facilitate any multi-country activities that would assist with the execution of activities or meeting project objectives; and
- Facilitate the dissemination of relevant project findings and recommendations globally.

Project Management Unit and Execution Arrangements

Owing to the specialized nature of the flood and drought modelling methodologies, the project executing agencies, DHI and IWA, will second existing project staff to the project to form the Project Management Unit (PMU). The PMU will include a technical coordinator from DHI and an outreach coordinator from IWA who will hold weekly management meetings, and secretarial and administrative support. The PMU will carry out the day-to-day administration of the Project and be responsible to the SC for the project activities, financial accountability, staff welfare and discipline, etc. All communications must be copied to both coordinators. The PMU will provide the SC with a draft budget review and work plan in sufficient time prior to the annual SC meeting. In terms of regular administrative reporting, the PMU will provide produce joint technical reports to UNEP management. The PMU will also assist UNEP in preparing the annual Project Implementation Review. Finally there will be a number of management, monitoring and evaluation activities that will be planned and supported by the PMU, including a midterm and final evaluation. The IWA and DHI coordinators will communicate separately to UNEP to provide their financial reports.

The PMU will tap into resources in IWA and DHI to support the delivery of the project. The DHI technical coordinator will work with a technical suppport team in DHI to develop and implement the DSS. Whereas, the IWA outreach coordinator will work with staff within IWA (outreach support team) on relevant tasks such as the design and operation of the website, for the organization of consultation and outreach conferences, workshops, and special events and for the production of dissemination materials and publications. These content support teams from IWA and DHI will report directly to the PMU. The coordinators from DHI and IWA will report to their respective line managers. If there are any issues around management, then the managers from IWA and DHI will be the first line of consultation.

The coordinators will be employees of DHI and IWA and will be tasked to coordinate the project, oversee the progress and quality of work and report to the Steering Committee. For example, the DHI technical coordinator will coordinate the inputs from the technical team developing the DSS in DHI (Component 1 & 2), whereas the IWA outreach coordinator will coordinate the stakeholder engagement, communication and dissemination (Component 3 & 4). Within both components there are activities which are undertaken jointly, so close cooperation is required. For example, in component 1, there is a stakeholder consultation at the project inception to incorporate end user needs into the DSS. The project management unit will have regular update meetings to enable smooth coordination of project inputs and outputs. They will also be responsible for semi-annual reporting, communication with partners and the UNEP task manager.

Permanent focal points in the three pilot basins (basin facilitators) will be selected among existing staff within the executing agencies that are present in the region. IWA will have staff in each of the pilot basins, and (potentially) the learning basins. These staff will have the role of relationship building and to facilitate that the basin visits from the coordinators and technical support teams are productive. The basin facilitators will report directly to the PMU. The project management unit will liaise with these contact points to organize meetings, identify stakeholders and implement actions on the ground assisted by short term DHI and IWA staff. For the specific DHI tasks, DHI may interact directly with the pilot basins. In such cases the basin facilitator will be kept informed.

Cooperation partners (see section 2.6) will be invited to participate in relevant project events (e.g. basin inception meetings and DSS testing and training in the pilot basins) and to contribute/comment on relevant project outputs. Final cooperation arrangements with these partners will be agreed during the inception period.

SECTION 5: STAKEHOLDER PARTICIPATION

The approach for integrating floods and droughts management into planning in transboundary waters requires a holistic decision support system for a variety of stakeholders from basin to local level, which includes an entire value chain from data analysis to processing to application in decision making. Stakeholders include land, water and urban area managers that need a technically and economically feasible and scientifically sound way to integrate the information on increased frequency, magnitude and unpredictability of flood and drought events into planning processes ranging from basin level integrated water resource management plans (IWRM) to city utility and industry water safety plans (WSP). This includes a suite of technical tools to support application on the ground, but also provides guidance on how to interpret and apply the information in decision making.

The Decision Support System (DSS) tools and workflow described for the project should be the "engine" of the methodology which will include 1) appropriate input data; 2) planning and management options/scenarios; 3) simulation of scenarios, with or without optimization and production of flood and drought indicators; and 4) evaluation and ranking of the scenarios using multi-criteria and cost benefit analyses. At all phases of the workflow, the tools will interact with the underlying data base and user interface of the DSS. There are key steps that will take place around this process which includes defining what type of information is needed by stakeholders, verification of the process by these stakeholders to ensure understanding and functionality, application of the information and also feedback to adjust the DSS tools and ensure that they are flexible and comprehensive to a variety of users within a transboundary basin.

One of the early steps within the project's inception will be to undertake stakeholder consultations in each pilot basin (3) and learning basin (2) to provide awareness of the project and provide further input and verify the methodology so it is relevant for end users (Activity 1.1.1.2). The process will first include identifying participants of each stakeholder consultation, which will be a mix of focus groups and key informant interviews. Secondly, meetings will be organized in each basin with relevant stakeholders, if possible in conjunction with planned events (e.g. IWA Development Congress). Also as part of basin inception activities, an assessment of social and gender issues will be undertaken in each pilot basin (activity 3.1.1.2). The input from stakeholders aims to provide verification and additional guidance to the floods and drought methodology. In Components 2 and 3, the application of the methodology is to be undertaken with users at the basin and local (e.g. utility) level. The aim is to ensure ownership of the process and secure the generic methodology adaptable to different contexts. In Component 4, there is the production and application of training materials, which will incorporate end user experiences and

recommendations based on practical application of the DSS. Finally, the dissemination will be undertaken in partnership with "champions" within the basin, for example, through presentations at international and regional events.

SECTION 6: MONITORING AND EVALUATION PLAN

The project will follow UNEP standard monitoring, reporting and evaluation processes and procedures. Substantive and financial project reporting requirements are summarized in Appendix 8. Reporting requirements and templates are an integral part of the UNEP legal instrument to be signed by the executing agency and UNEP.

The project M&E plan is consistent with the GEF Monitoring and Evaluation policy. The Project Results Framework presented in Appendix 4 includes SMART indicators for each expected outcome as well as mid-term and end-of-project targets. These indicators along with the key deliverables and benchmarks included in Appendix 6 will be the main tools for assessing project implementation progress and whether project results are being achieved. The means of verification and the costs associated with obtaining the information to track the indicators are summarized in Appendix 7. Other M&E related costs are also presented in the Costed M&E Plan and are fully integrated in the overall project budget.

The M&E plan will be reviewed and revised as necessary during the project inception workshop to ensure project stakeholders understand their roles and responsibilities vis-à-vis project monitoring and evaluation. Indicators and their means of verification may also be fine-tuned at the inception workshop. Day-to-day project monitoring is the responsibility of the project management team but other project partners will have responsibilities to collect specific information to track the indicators. It is the responsibility of the PMU to inform UNEP of any delays or difficulties faced during implementation so that the appropriate support or corrective measures can be adopted in a timely fashion.

The project Steering Committee will receive periodic reports on progress and will make recommendations to UNEP concerning the need to revise any aspects of the Results Framework or the M&E plan. Project oversight to ensure that the project meets UNEP and GEF policies and procedures is the responsibility to the Task Manager in UNEP-GEF. The Task Manager will also review the quality of draft project outputs, provide feedback to the project partners, and establish peer review procedures to ensure adequate quality of scientific and technical outputs and publications.

Type of M&E activity	Responsible Parties	Time frame
Inception Workshop *including confirmation of logframe at basin and global levels and development of gender disaggregated indicators as appropriate.*	PMU	Within first two months of project start up
Inception Report	PMU and Executing Agencies UNEP DEPI	Immediately following workshop
Measurements of Means of Verification for Project Progress and Performance (measured on an annual basis)	PMU External consultants when required Executing Agencies	Annually

APR and PIR	PMU and Executing Agencies UNEP DEPI	Annually
TPR and TPR report	Government Counterparts Project team UNEP-GEF	Every year, upon receipt of APR
Steering Committee Meetings	PMU Project Steering Committee UNEP DEPI Executing Agencies	Following Project Inception and subsequently at least once a year
Quarterly Progress Reports	PMU	Quarterly
Mid Term Evaluation	PMU UNEP EOU External Consultants	At mid term.
Final External Evaluation	PMU UNEP EOU External Consultants	At the end of project implementation
Terminal Report	PMU	At least one month before the end of the project
Lessons learned	PMU External Consultants as required	Yearly
Audit	PMU External Auditor UNEP DEPI	Yearly
Total Indicative Cost - *Excluding project team staff time and UNEP staff and travel expenses*		85,000 USD

Project supervision will take an adaptive management approach. The PMU will develop a project supervision plan at the inception of the project that will be communicated to the project partners during the inception workshop. The emphasis of the PMU supervision will be on outcome monitoring but without neglecting project financial management and implementation monitoring. Progress vis-à-vis delivering the agreed project global environmental benefits will be assessed with the Steering Committee at agreed intervals. Project risks and assumptions will be regularly monitored both by project partners and UNEP. Risk assessment and rating is an integral part of the Project Implementation Review (PIR). The quality of project monitoring and evaluation will also be reviewed and rated as part of the PIR. Key financial parameters will be monitored quarterly to ensure cost-effective use of financial resources.

An independent terminal evaluation will take place at the end of project implementation, and the process will be managed by UNEP's Evaluation Office. The terminal evaluation (TE) will provide an independent assessment of project performance (in terms of relevance, effectiveness and efficiency), and determine the likelihood of impact and sustainability. It will have two primary purposes: (i) to provide evidence of results to meet accountability requirements, and (ii) to promote learning, feedback, and knowledge sharing through results and lessons learned among UNEP, the GEF and the executing partners. A review of

the quality of the evaluation report will be submitted along with the report to the GEF Evaluation Office not later than 6 months after the operational completion of the project.

SECTION 7: PROJECT FINANCING AND BUDGET

7.1. Overall project budget

The GEF Project budget is fully developed in Appendix 1, over a 4-year period. The main budget components and costs are summarized in the following table:

UNEP Budget Components	**COSTS (US$)**	
	GEF	**Co-finance**
Personnel Component Project personnel, including PMU cost, Consultants for developing training material, missions travels	3,731,668	14,774,367
Subcontractor Component Supporting agencies/institutions		
Training Component National and regional training courses	208,810	2,533,611
Equipment and Premises Expendable equipment, Non-expandable equipment, Premises costs	10,640	396,055
Miscellaneous Component Operation and maintenance of equipment, Reporting costs (printing and publishing), Communication costs, Project evaluation	138,882	4,760,809
Total Budget	4,090,000	22,464,842

7.2. Project co-financing

Project co-financing has been committed from various stakeholders including Executing Agencies, the Implementing Agency, and stakeholders in both pilot and learning basins. Commitment from stakeholders has been made through the submission of respective co-finance letters to UNEP which ensure the provision of these funds throughout the duration of the project. The cash and in kind co-financing will complement the GEF funded activities as per the project's budget.

The following table indicates the co-financing committed per stakeholder and amount.

Organization	**Amount (USD)**
Implementing agency	
UNEP	733,000
Executing agencies	
DHI	11,277,000
IWA	2,919,842
Other stakeholders	
UNEP DHI	100,000
Volta Basin Authority	3,785,000

Lake Victoria Basin Commission	3,000,000
International Commission for the Protection of the Danube River (ICPDR)	650,000
	22,464,842

7.3. Project cost-effectiveness

Expanding the use of existing Decision Support Systems through a generic methodology to include consideration of extreme climatic events implies sophisticated and very expensive know-how. Such capabilities would have been beyond the reach of a GEF project without the cooperation with DHI, a non-profit foundation dedicated, amongst others, to water related Decision Support Systems, and of IWA, an association focused on water industry and water utilities. The project can hence be considered cost-effective if compared to commercial DSS development.

APPENDIXES

Appendix 1: Budget by project components and UNEP budget lines

Budget in UNEP format…see attached Excel Sheet

Appendix 2: Co-financing by source and UNEP budget lines

See attached Excel Sheet

Appendix 3: Incremental Reasoning

Benefit	Baseline (B)	Alternative (A)	Increment (A-B)
Global Benefits	Overall degradation of water resources within basin contexts compounded by increased frequency and unpredictability of Floods and Droughts.	Resources managers and policy makers in Basins enabled to factor F&D in safety water resources planning, IWRM, and in the TDA-SAP process of GEF IW projects.	Open access DSS tools tailored to the need to integrate consideration of F&D into water resources management made broadly available.
Domestic Benefits	Stakeholders barely knowledgeable about ways to cope with increased frequency and unpredictability of F&D.	Software modules and user guidelines allow integration of F&D consideration into TDAs, IWRM and Water Safety Planning	Tools and capacity developed and adapted for local application as part of TDAs, IWRM and WSPs.
Component 0	Current practices in addressing F&D impacts as part of planning processes in transboundary basins and basins draining into transboundary LMEs, including the TDA-SAP process, lack systematic consideration of F&Ds.	Assessment of presently adopted ways to introduce F&Ds into IWRM, WSPs, and TDA-SAP processes performed during preparation, and identification of five pilot basins for learning and testing purposes.	Project design incorporating finding of the assessment.
Component 1	Existing tools and methodologies for addressing extreme climatic events as part of water, land and urban areas planning processes, lack comprehensive approach and	Methodology with DSS tools aimed at increasing understanding of F&D dynamics and impacts at transboundary and national levels and including	Specifications of methodological approach, guidelines and training materials.

	stakeholder validation.	enhancement of commonly used decision support systems, fully developed jointly with pilot basins stakeholders.	
Component 2	Existing IWRM Plans and TDAs do not take into full consideration the impacts of floods and droughts and of their transboundary implications.	Application of newly developed methodology with DSS tools enables the integration of F&D consideration into the IWRM, TDA-SAP, Water Safety and other planning processes.	Recommendations for integrating F&Ds in TDA-SAPs, IWRM and other planning processes in 3 pilot basisns.
Component 3	Present approaches to water safety and supply planning are fragmented, not integral to basin management, and do not focus on F&Ds issues and their transboundary implications.	Application of the new methodology with DSS tools at lower administrative levels within basins enables increased resilience and preparedness to F&D within broader basin context .	Enhanced land and water planning instruments in at least 3 urban areas within the pilot basins.
Component 4	Lack of awareness of key stakeholders on ways to address increased frequency and unpredictability of F&Ds, and of focus of the international discourse on water policy on its transboundary implications.	Increased knowledge and access to methodology with DSS tools foster response at local, national and transboundary levels.	A complete learning package including technical specifications and training materials for the application of the new methodological approach, made broadly available.

Appendix 4: Results Framework

Project Objective The objective of the project is to improve the ability of land, water and urban area managers operating in transboundary river basins to recognize and address, as part of the TDA-SAP, IWRM and water safety planning processes, the implications of the increased frequency, magnitude and unpredictability of flood and drought events (F&D).				
Objectively Verifiable Indicators			**Means of Verification**	**Assumptions**
Indicator	**Baseline**	**Target**		
A methodology with DSS tools, including the enhancement of decision support systems to recognize and address the impacts and the transboundary implications of floods and droughts on human livelihoods, economic activities, and ecosystems – developed and tested in three representative pilot basins. (P)	GEF client countries, transboundary basin organizations, and end users including water suppliers, regulators, and industries, lack adequate guidance and tools for addressing the impacts and the transboundary implications of the increasing frequency of floods and droughts.	A flexible methodological approach with DSS tools addressing stakeholder priorities, especially the impact on end users, is fully developed, and tested in three pilot basins.	Software package, and training documentation; Pilot Basins Reports; Testimonials from basin end-users.	Present understanding of future climatic scenarios, coupled with modern and broadly accessible monitoring and modeling tools, will allow the development of a flexible, generic methodological approach; potential basin end-users are interested and able to engage in the process.

Component 1 Development of methodology and tools	**Objectively Verifiable Indicators**			**Means of Verification**	**Assumptions**
	Indicator	**Baseline**	**Target**		
Outcome 1.1 A methodology with DSS tools aimed at increasing understanding of F&D dynamics and impacts at transboundary and national levels and including enhancement of commonly used decision support systems, fully developed jointly	Methodology, guidance and training materials available. Reports and recommendations available following revision of methodology to accommodate basin stakeholders' concerns.	Existing tools and methodologies for addressing extreme climatic events as part of water, land and urban areas planning processes, lack comprehensive approach and stakeholder validation.	New generic methodological approach, ready for consultative processes and for on the ground application in 3 selected basins and pilot sites.	Package containing detailed specifications of the methodological approach, enhancement of commonly used decision support systems, guidance and training materials, ready	Presently existing and easily accessible monitoring systems and modeling tools will allow the development of a broadly applicable methodological approach.

with pilot basins stakeholders.				for consultations and testing.	

Output for Outcome 1.1:
1) A methodology with DSS tools adopting a basin approach, including enhancements for decision support systems, that would allow the integration of F&D consideration into (i) the TDA-SAP GEF IW or equivalent processes, and (ii) IWRM plans and Water Safety Plans.
2) Guidance materials for the application of the Methodology with DSS tools.

Component 2 Validation and testing at basin-wide level	**Objectively Verifiable Indicators**			**Means of Verification**	**Assumptions**
	Indicator	**Baseline**	**Target**		
Outcome 2.1 Application of the methodology with DSS tools in the three pilot basins enables the integration of F&D consideration into the IWRM, TDA-SAP, Water Safety and other planning processes.	Reports available from the three pilot testing exercises. Management options and recommendations formulated for managing floods and droughts in transboundary basins. (P)	Present efforts to develop IWRM Plans and TDAs unable to take into full consideration the expected growing impacts of floods and droughts and of their transboundary implications.	Recommendations for integrating floods and droughts in TDA-SAPs and IWRM plans developed in 3 pilot basins.	Final Pilot Basin Reports presented and discussed at workshops at basin level.	Governments of the participating countries and key stakeholders convinced of the importance of addressing floods and droughts as part of the TDA and IWRM processes, will cooperate actively to the refinement, experimentation and testing of the new methodological approach.

Outputs for Outcome 2.1
1) Strategic recommendations for inclusion of flood and droughts consideration in IWRM, TDA, Water-Safety and other basin land and water planning tools in the 3 selected pilot basins.

Component 3 Validation and testing at local level	**Objectively Verifiable Indicators**			**Means of Verification**	**Assumptions**
	Indicator	**Baseline**	**Target**		
Outcome 3.1 Uptake of the methodology with DSS tools at lower administrative levels within basins enables	Water Safety Plans and other land and water planning instruments developed by key stakeholders in identified sites	Present approaches to water safety and supply planning adopted by water suppliers and	At least 3 end users (e.g. a utility) within the 3 project pilot basins integrate the project findings and recommendations	Documented cases of enhanced land and water planning instruments in pilot basins, e.g.: for water	Stakeholders in pilot basins, including those in urban areas including utilities and industries, will participate in

water suppliers and regulators, (agro) industries and urban area managers to consider options for increased resilience and preparedness to F&D within broader basin context with an emphasis on vulnerable groups affected by water related shocks.	within pilot basins, incorporate the findings and guidance on flood and drought management in transboundary contexts derived from the application of the new basin-wide methodological approach. (P)	regulators, cities and industries, are generally fragmented, not integral to basin management, and do not focus on floods and droughts issues and their transboundary implications.	into land and water planning instruments while cooperating with stakeholders in the wider basin.	safety, urban drainage and flood protection, and industrial water supply. The planning tools are used by the water utilities and recognized by the respective authorities across each pilot basin.	project activities, cooperate with basin organizations and governmental bodies, and engage in reforming their water safety plans and other planning instruments.
Outputs for Outcome 3.1 1) Downscaled methodology with DSS tools for integration in at least 3 urban areas with urban and (agro)industrial water users perspectives and realities in floods and droughts planning at basin level. 2) Recommendations for updated plans, including investments, for utility water safety , urban drainage and socio-economic urban areas vulnerable to F&D, incorporating basin level constraints and outlooks.					

Component 4 Capacity building and dissemination	**Objectively Verifiable Indicators**			**Means of Verification**	**Assumptions**
	Indicator	**Baseline**	**Target**		
Outcome 4.1 Experience and know how gained through the project is made available within the GEF system and beyond.	A complete learning package including technical specifications and training materials for the application of the new methodological approach, integrating the results of consultations and of its testing in pilot basins. (P)	Land, water and urban managers, and key stakeholders lack access to approaches and tools and guidance on the modalities of their application.	Broadly applicable training and technology transfer package, developed with the contribution of key stakeholders and decision makers in all pilot basin.	Technology Transfer Report, providing evidence of (i) the participation of decision makers and other stakeholders to the capacity building activities, (ii) their positive evaluation of the activities effectiveness, and (iii) their contribution to the finalization of the technology transfer package.	The project's implementing and executing agencies are able to facilitate and foster the engagement of, and cooperation among the complex set of actors involved in floods and droughts management.
Outcome 4.2 Global dialogue on water security and climate resilience enriched by the	Communication materials and messages developed by the project feature	The GEF IW Strategies and the international discourse on	Future GEF Strategies, and global water processes show	Number of Experience Notes and other documents and audio-visual	

dissemination of and awareness raising on project outcomes.	prominently at the WWF, Water Week, GEF IWC 8/9, and IWA Conferences and other major water events. (P)	water policy lack focus on the transboundary implications of the increased frequency of extreme climatic events.	adherence to the approach developed by the project.	materials produced for IW LEARN dissemination mechanisms and website. GEF foundational projects adopt the application of the new methodological approach as part of the TDA-SAP process, and implementation of IWRM.	

Output for Outcome 4.1
1) Learning package including technical specifications and training materials for the application of the new methodology with DSS tools is tested in 2-3 trainings with basin officials, utility and industry management and operational staff, and representatives from civil society with 15-30 people per training.

Output for Outcome 4.2
1) 2-3 Experience Notes and other documents and audio-visual materials produced for IW LEARN dissemination mechanisms and website.
2) Communication materials (4-5) developed for and participation in major water events: WWF, Water Week, GEF IWC 8/9, and IWA Conferences.

Appendix 5: Workplan and timetable	**Title: Development of tools to incorporate impacts of climatic variability and change, in particular floods and droughts, into basin planning processes**																		
	Project objective: The objective of the project is to improve the ability of land, water and urban area managers operating in transboundary river basins and contexts[1] to recognize and address, as part of the TDA-SAP, IWRM and water safety planning processes, the implications of the increased frequency, magnitude and unpredictability of flood and drought events (F&D).	**Year 1**				**Year 2**				**Year 3**				**Year 4**					

	Activity	**Organ-ization**	**Outputs**	**Inputs**	**Q1**	**Q2**	**Q3**	**Q4**	**Q1**	**Q2**	**Q3**	**Q4**	**Q1**	**Q2**	**Q3**	**Q4**	**Q1**	**Q2**	**Q3**
Component 0	**Preparation and Inception activities**																		
Outcome 0.1	**Enhanced focus and effectiveness of final project design achieved through the assessment of current practices in addressing F&D impacts as part of planning processes in transboundary basins, including the TDA-SAP process**																		
Output 0.1.1	*Reports containing review of GEF portfolio, case studies, mapping and assessment of current decision making processes, highlighting strengths, weaknesses and any gaps identified (including those related to data and information*																		
Outcome 0.2	**Identification during project preparation of three transboundary basins for participatory development and pilot testing of the new methodologyand tools, ensures timely inception and smooth project implementation**																		
Output 0.1.2	*Selection of three pilot basins and two learning basins based on a review of all river/lake*																		

	Activity	Organ-ization	Outputs	Inputs	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3
	basins object of foundational GEF IW projects including the TDA-SAP process																		
Output 0.1.3	*Project inception with the participation of GEF Project Agencies and of Pilot Basin representatives*	**IWA/DHI**	Project inception report	Staff, travel costs, meeting costs															
Component 1	**Development of methodology**																		
Outcome 1.1	***A Methodology with tools aimed at increasing understanding of F&D dynamics and impacts at transboundary and national levels and including enhancement of commonly used decision support systems, fully developed jointly with pilot basins stakeholders.***																		
Output 1.1.1	*A methodology with tools adopting a basin approach, including enhancements for decision support systems, that would allow the integration of F&D consideration into (i) the TDA-SAP GEF IW or equivalent processes, and (ii) IWRM plans and Water Safety plans*																		
Activity 1.1.1.1	Development and integration of F&D components for DSS systems	DHI																	
Task 1	Describe impacts/issues/consequences of floods and droughts in a transboundary basin context (what are the problems to be solved)		See below	Staff															
Task 2	Identify F&D indices (indications that there is a problem), the means these can be monitored or predicted, and the data and analytical tools required;		See below	Staff															
Task 3	Outline a DSS , which can		See below	Staff															

	Activity	Organ-ization	Outputs	Inputs	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3
	accommodate F&D situations considering technical, economic and environmental aspects (including risks and consequences);																		
Task 4	Prepare a description of overall methodology for application of the F&D DSS components for use at stakeholder consultations		Report on overall methodology for application of F&D DSS components to be applied in the project	Staff															
Activity 1.1.1.2	Stakeholder consultations in each pilot (3 basins) and learning basin (1 basin) to provide awareness of the project and provide further input and verify the methodology so it is relevant for end users	IWA with DHI support																	
Task 1	Identify 15-30 participants to participate in each stakeholder consultation, which will be a mix of focus groups and key informant interviews		Participant list and invitations to 4 stakeholder consultations	Staff															
Task 2	Organize meetings in each pilot basin with relevant stakeholders, if possible in conjunction with planned events (e.g. IWA conferences). There will be an emphasis on identifying existing flood and drought planning and response processes to identify gaps that the DSS can address.		5 meeting reports with verification of generic methodology	Staff, travel costs, meeting costs															
Task 3	During stakeholder consultations identify impacts on vulnerable groups affected by water related shocks. This will be further expanded in Activity 3.1.1.2		Meeting report includes impacts on vulnerable groups affected by water related shocks	Staff															
Task 4	Summarize discussions in stakeholders consultations into a report which provide end user verification and additional		Meeting report with verification of generic methodology	Staff															

	Activity	Organ-ization	Outputs	Inputs	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3
	guidance to floods and drought methodology																		
Activity 1.1.1.3	Develop and quality test DSS codes which integrates flood and drought management decisions in water resources management	DHI																	
Task 1	Prepare a detailed design of F&D DSS components		Outline of F&D DSS components	Staff															
Task 2	Prepare a software development plan		Software development plan	Staff, software development															
Activity 1.1.1.4	Estimate F&D impact and adaptation from climate changes	DHI																	
Task 1	Describe approach for estimating F&D impacts from changes in climate change including current best practices for estimating key climate parameters to be used in decision making;		See below	Staff															
Task 2	Collect and analyze empirical evidence of changes in floods and droughts based on changes in climatic parameters to the three pilot basins		See below	Staff															
Task 3	Inventory of previous and existing initiatives related to climate change and taking contact to those that may be relevant for cooperation/lessons learnt including World Bank supported initiatives such as WB GAMS (ref. section 3.1.2)		Inventory of previous and existing initiatives	Staff															
Task 4	Develop downscaling DSS components for global climate change impacts in F&D context basins		Report on downscaling DSS components for global climate change impacts in F&D context basins	Staff															
Activity 1.1.1.5	Develop a methodology to apply DSSs in TDA/SAP, IWRM and WSP	DHI																	

	Activity	Organ-ization	Outputs	Inputs	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3
Task 1	Demonstrate the use of DSS with representatives from basin organizations, urban water utilities and relevant industries to resolve typical hot-spot issues in TDA/SAP, IWRM and WSP processes																		
Task 2	Test applicability in model transboundary basin																		
Task 3	Consolidate stakeholder input to methodology to apply DSS																		
Task 4	Prepare outline manuals and guidance																		
Output 1.1.2	*Guidance materials for the application of the Methodology with DSS tools*																		
Activity 1.1.2.1	Prepare consolidated manuals and guidance for application	DHI with IWA support																	
Task 1	Accumulate experience from applications		Report on application experience through interviews and questionnaires	Staff, travel costs															
Task 2	Prepare guidance material based on experience of use. Material will include, system manuals, approaches, methodologies and demos. Methodologies refer to management tools and approaches which could be recommended and/or implemented by partners as a result of deploying the DSS in the basins.		Application manual (review of information) - working document	Staff, material production															
Task 3	Test format and usefulness of guidance material on a number of selected trainees		Reports from seletected trainees through interviews and questionnaires	Staff															
Component 2	**Validation and testing at basin-wide level**																		

	Activity	Organ-ization	Outputs	Inputs	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3
Ouctome 2.1	***Application of the methodology with DSS tools in the three pilot basins enables the integration of F&D consideration into the IWRM, TDA-SAP, Water Safety and other planning processes.***																		
Output 2.1.1	*Strategic recommendations for inclusion of flood and droughts consideration in IWRM, TDA, Water-Safety and other basin land and water planning tools in the 3 selected pilot basins.*																		
Activity 2.1.1.1	Establish working environment for application of methodology with DSS tools in pilot basins – DHI with IWA input	DHI with IWA support																	
Task 1	Plan application in pilot basins together with project partners		Plan for implementation of methodological approach	Staff, travel costs															
Task 2	Transboundary basin and national water managers who are specifically involved in responding to water related risks provide guidance to identify and select specific areas for application. Involvement of relevant civil society to ensure that areas selected take into account vulnerable areas impacted by floods and droughts. The relevant civil society representatives will be identified during the stakeholder consultations (Activity 1.1.1.2)		Report on application of methodology in basins (1 meeting)	Staff, meeting costs, travel costs (1 meeting)															
Activity 2.1.1.2	Apply F&D Components in a DSS for TDA/SAP, IWRM and other basin land and water planning tools in selected basins	DHI																	
Task 1	Demonstrate the potential of an enhanced DSS in specific cases		See below	Staff, travel costs, meeting															

	Activity	Organ-ization	Outputs	Inputs	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3
	in three pilot basins,			costs															
Task 2	In cooperation with transboundary basins and national water managers involved in activity 2.1.1.1 demonstrate the applicability and usefulness of the DSS in the in GEF IW projects and IWRM plans in the three pilot basins. Simultaneously provide training on the application of the flood and drought DSS to end users including basin officials (transboundary and national), and urban managers from water utilities and industry.		Report on application of F&D components	Staff, travel costs, meeting costs															
Activity 2.1.1.3	Recommend policy and strategy for F&D in consultation with stakeholders	DHI with IWA support																	
Task 1	With transboundary basins and national water managers involved in activities 2.1.1.1 and 2.1.1.2, prepare strategic recommendations for inclusion of flood and droughts consideration in IWRM, TDA/SAP and other basin-wide land and water plans in selected basins		Document with strategic recommendations prepared in consultation with keystakeholders	staff, travel costs, meeting costs (3 meetings)															
Task 2	Develop documentation of the process to provide basin specific guidance on how to use information from the floods and drought components of a DSS in developing recommendations for planning.		Document specifying guidance for application to pilot basins	Staff															
Component 3	**Validation and testing at local level**																		
Outcome 3.1	***Uptake of the methodology with DSS tools at lower administrative levels within the 3 pilot basins enables***																		

	Activity	Organ-ization	Outputs	Inputs	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3
	water suppliers and regulators, (agro) industries and urban area managers to consider options for increased resilience and preparedness to F&D within broader basin context with an emphasis on vulnerable groups affected by water related shocks.																		
Output 3.1.1	*Downscaled methodology with DSS tools for integration in at least 3 urban areas with of urban and (agro)industrial water users perspectives and realities in floods and droughts planning at basin level.*																		
Activity 3.1.1.1	Cooperate with utilities to identify test areas	IWA (with DHI support)																	
Task 1	With guidance from basin representatives and urban water managers, screen and select at least 3 water utilities (one in each pilot basin) with motivation and knowledge to participate as test cases		Water utilities selected in 3 pilot basins	Staff, travel															
Task 2	Identify, together with selected water utilities, a test area in each of the pilot basins, where F&D interferes with the water safety in a significant manner. Involvement of relevant civil society to ensure that the test areas selected take into account vulnerable localities impacted by floods and droughts.		Test areas selected	Staff															
Activity 3.1.1.2	Assessment of the gender and social dimensions in F&D management	IWA (with DHI support)																	
Task 1	Consultations and stakeholder involvement in flood prone areas within pilot basins		Documentation on the gender and social dimensions of F&D management	Staff															
Task 2	Identify water relevant gender		Gender indicators	Staff															

	Activity	Organ-ization	Outputs	Inputs	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3
	indicators being adopted and monitored by countries, if any.																		
Task 3	Identify impacts of droughts on men and women/girls, including hygiene, and analyze options for diversified livelihood support for women during droughts.		Documentation on the impacts of drought to different groups and options for diversified livelihood support	Staff															
Activity 3.1.1.3	Develop downscaled methodology with DSS tools for incorporating F&D into planning processes in collaboration with key end users in pilot basins	DHI with IWA support																	
Task 1	Adapt the DSS/F&D methodology to cover the size of the test areas	IWA (with DHI support)	Downscaled methodological approach developed through workshop with users, experts and partners	Staff, members, meeting costs, travel costs															
Task 2	Investigate the need for urban drainage models	DHI																	
Activity 3.1.1.4	Support application of methodology with DSS tools in at least 3 urban areas in the pilot basins through involving utilities and industry end users	IWA																	
Task 1	Apply a suitable model to test at least one urban area/catchment within each of the 3 pilot basins with the ultimate purpose of improving the resilience and preparedness through appropriate planning and implementation of mitigating measures. Simultaneously provide training on application of the downscaled methodology during implementation with water utility and industry representatives.	DHI	Tested downscaled methodology in 3 pilot basins	Staff, members, meeting costs, travel costs															

	Activity	Organ-ization	Outputs	Inputs	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3
Task 2	Incorporate recommendations from application of F&D methodology into planning processes (e.g. WSP)	IWA	Report with recommendations for incorporation of F&D methodology in planning processes for 3 pilot basins	Staff, members															
Output 3.1.2	*Recommendations for updated plans, including investments, for utility water safety and, urban drainage and socio-economic urban areas vulnerable to F&D incorporating basin level constraints and outlooks.*																		
Activity 3.1.2.1	Work with utilities to use recommendations derived from DSS/F&D assessments to provide input into plans	IWA (with DHI support)																	
Task 1	Establish critical factors (e.g. water levels) for water safety and urban drainage at the selected test areas/catchments and assess impacts, risks and frequencies		See below	Staff, travel costs, meeting costs															
Activity 3.1.2.2	Document the design and implementation process of F&D methodology in pilot basins to be communicated to a wide range of stakeholders	IWA																	
Task 1	Develop communication strategy to collect and use information on application of F&D methodology in the 3 pilot basins and urban areas. This includes management tools and methodologies which could be recommended and/or implemented by partners as a result of deploying the DSS in the basins		Communication strategy	Staff															
Task 2	Collect and collate information from the pilot basins through various media - video, blogs,		Series of communication outputs - reports,	Staff, consultants, Communications															

	Activity	Organ-ization	Outputs	Inputs	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3
	interviews, focus groups, etc.		videos, blogs, etc.	products, travel costs															
Component 4	**Capacity building and dissemination**																		
Ouctome 4.1	Experience and know how gained through the project is made available within the GEF system and beyond.																		
Output 4.1.1	Learning package including technical specifications and training materials for the application of the new methodology with DSS tools is tested in 2-3 trainings with basin officials, utility and industry management and operational staff, and representatives from civil society with 15-30 people per training.																		
Activity 4.1.1.1	Prepare technical specifications, manuals, guidance and training materials	IWA (with DHI support)																	
Task 1	Identify potential basin, water utility and industry users' levels of knowledge and establish their need for knowledge and training. This includes those involved in the development of the DSS tool and additional users who would apply the tool and use the outputs.		Survey on users level of knowledge and need for training	Staff, travel															
Task 2	Establish and consult with international pool of experts to define guideline materials needed for incorporating F&D methodology into planning processes		Outline of guidelines to be developed	Staff, IWA members, travel costs, meeting costs															
Task 3	Preparation of technical specifications and user manuals enabling professional level staff to apply the methodology and models and prepare water		Outline of guidelines to be developed	Staff															

	Activity	Organ-ization	Outputs	Inputs	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3
	safety plans																		
Task 4	Prepare technical specifications and user manuals enabling professional level staff to apply the methodology and models and prepare water safety plans		Guidelines and training material	Staff, members															
Activity 4.1.1.2	Prepare training module on application of F&D methodological approach from basin to end user for inclusion in existing training courses	IWA																	
Task 1	Development of module that contains information on F&D methodological approach in catchment and end user context into WSP training		Module on F&D for WSP training	Staff, members															
Task 2	Testing of module in 2-3 existing trainings on WSP to build the capacity of end users (basin representatives, water utility and industry users) in understanding the DSS application and use of the results in planning (e.g. water safety planning). Training will have between 15-30 participants.		Report from training workshop	Staff															
Outcome 4.2	***Global dialogue on water security and adaptation to climate variability and change enriched by the dissemination of and awareness raising on project outcomes.***																		
Output 4.2.1	*2-3 Experience Notes and other documents and audio-visual materials produced for IW LEARN dissemination mechanisms and website.*																		
Activity 4.2.1.1	Audiovisuals, documents and other materials for global dissemination with an emphasis on IW LEARN (67,000 USD – 1.6% of total grant)	IWA (with DHI support)																	
Task 1	Analyze IW LEARN mechanisms and their		Report on information to	Staff,															

	Activity	Organ-ization	Outputs	Inputs	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3
	requirements to materials in order to streamline it with the existing materials and to make it accessible on a global scale		develop																
Task 2	Prepare and adjust materials on the methodology and the application to meet the requirements of IW LEARN		Briefing notes, videos, publications, etc. for IW LEARN and other events	Staff, Communications products															
Task 3	Identify other dissemination channels in order to reach out broadly including development of project website		Project website	Staff, website															
Task 4	Participation in IW LEARN events		Reports from 2 IWA LEARN events	Travel															
Output 4.2.2	*Communication materials (4-5) developed and disseminated at major water events: WWF, Water Week, GEF IWC 8/9/9, and IWA Conferences.*																		
Activity 4.2.2.1	Prepare brochures, leaflets, CDs and materials suitable for water events	IWA (with DHI support)																	
Task 1	Identify water events scheduled for the near future and where the methodology would be a relevant topic for presentation		List of water events	Staff															
Task 2	Prepare presentation material tailor-made to water events (pamphlets, CDs, posters etc)		Pamphlets, CDs, posters	Staff, Communications products															
Activity 4.2.2.2	Organization of and participation in international conferences and workshops for the dissemination of methodological approaches and technical solutions across networks	IWA																	
Task 1	Organization and facilitation of workshops at key events including (but not limited to): IWA World Water Congress (Lisbon (Portugal), September 2014 // Brisbane (Australia), September 2016),		Workshop programme and reports from (3-4 events)	Staff, meeting costs, travel costs															

	Activity	Organ-ization	Outputs	Inputs	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3
	IWA Development Congress (Nairobi (Kenya), October 2013) IWA Conference on Water, Climate and Energy (Cape town, February 2014).																		
Task 2	Support key stakeholders to attend and present at international events		Workshop programme and reports (3-4 events)	Travel costs															
Project operation and management																			
	Partner meetings	DHI/IWA	Reports from meetings	Travel costs															

Appendix 6: Key deliverables and benchmarks

	Output	Expected Result	Deliverables	Benchmark	Timing (Y, Q)
1.1.1	A methodology with DSS tools adopting a basin approach, including enhancements for decision support systems, that would allow the integration of F&D consideration into (i) the TDA-SAP GEF IW or equivalent processes, and (ii) IWRM plans and Water Safety plans.	Increased understanding of F&D dynamics and impacts at transboundary and national levels and including enhancement of commonly used decision support systems, fully developed jointly with pilot basins stakeholders.	Methodology to apply DSSs and tested DSS codes integrating flood and drought management decisions in water resources management in TDA/SAP, IWRM and WSP.	Report describing methodology and open access DSS tools.	**(Y2,Q1)**
1.1.2	Guidance materials for the application of the Methodology with DSS tools			Consolidated manuals and application guidelines	**(Y2,Q2)**
2.1.1	Strategic recommendations for inclusion of flood and droughts consideration in IWRM, TDA, Water-Safety and other basin land and water planning tools in the 3 selected pilot basins.	Application of the methodology with DSS tools in 3 pilot basins enables the integration of F&D consideration into the IWRM, TDA-SAP, Water Safety and other planning processes.	Documentation on the process followed in the application of the methodology with DSS tools to pilot basins to provide basin specific guidance.	Pilot Basin Reports	**(Y3,Q2)**
3.1.1	Downscaled methodology with DSS tools for integration in at least 3 urban areas of with of	Uptake of the methodology with DSS tools at lower administrative levels within	Downscaled methodology with DSS tools for incorporating F&D into	Report describing tested downscaled methodology	**(Y4,Q1)**

	urban and (agro)industrial water users perspectives and realities in floods and droughts planning at basin level.	the 3 pilot basins enables water suppliers and regulators, (agro) industries and urban area managers to consider options for increased resilience and preparedness to F&D within broader basin context.	planning processes at sub-basin or local level.		
3.1.2	Recommendations for updated plans, including investments, for utility water safety and, urban drainage and socio-economic urban areas vulnerable to F&D, incorporating basin level constraints and outlooks.			Report describing the pilot testing process and results obtained.	**(Y4,Q2)**
4.1.1	Learning package including technical specifications and training materials for the application of the new methodology with DSS tools is tested in 2-3 trainings with basin officials, utility and industry management and operational staff, and representatives from civil society with 15-30 people per training	Experience and know how gained through the project is made available within the GEF system and beyond.	Technical specifications, manuals, guidance and training materials.	Training module on application of F&D methodological approach from basin to end-user.	**(Y4,Q3)**
4.2.1	2-3 Experience Notes and other documents and audio-visual materials	Global dialogue on water security and climate resilience is	Audiovisuals, documents and other materials for global dissemination.	Documentation and dissemination materials and tools posted on	**(Y4,Q4)**

	produced for IW LEARN dissemination mechanisms and website.	enriched by the dissemination of project outcomes.		project website and IW LEARN platform.	
4.2.2	Communication materials (4-5) developed and disseminated through participation at major water events: WWF, Water Week, GEF IWC 8/9, and IWA Conferences.		Brochures, leaflets, CDs and materials suitable for water events	Workshop Reports	**(Y4,Q4)**

Appendix 7: Costed M&E plan

Type of M&E activity	Responsible Parties	Budget US$ *Excluding project team Staff time*	Time frame
Inception Workshop *Including confirmation of logframe at basin and global levels and development of gender disaggregated indicators as appropriate.*	• PMU • DHI - IWA	None	Within first two months of project start up
Inception Report	• PMU and Executing Agencies • UNEP DEPI	None	Immediately following workshop
Measurements of Means of Verification for Project Progress and Performance (measured on an annual basis)	• PMU • External consultants when required • Executing Agencies		Annually
APR and PIR	• PMU and Executing Agencies • UNEP DEPI	None	Annually
Steering Committee Meetings	• PMU • Project Steering Committee • UNEP DEPI • Executing Agencies	None	Following Project Inception and subsequently at least once a year
Quarterly Progress Reports	• PMU	None	Quarterly
Mid Term Evaluation	• PMU • UNEP EOU • External Consultant	35,000	
Final External Evaluation	• PMU • UNEP EOU • External Consultants	40,000	At the end of project implementation
Terminal Report	• PMU	None	At least one month before the end of the project
Lessons learned	• PMU	6,000	Yearly

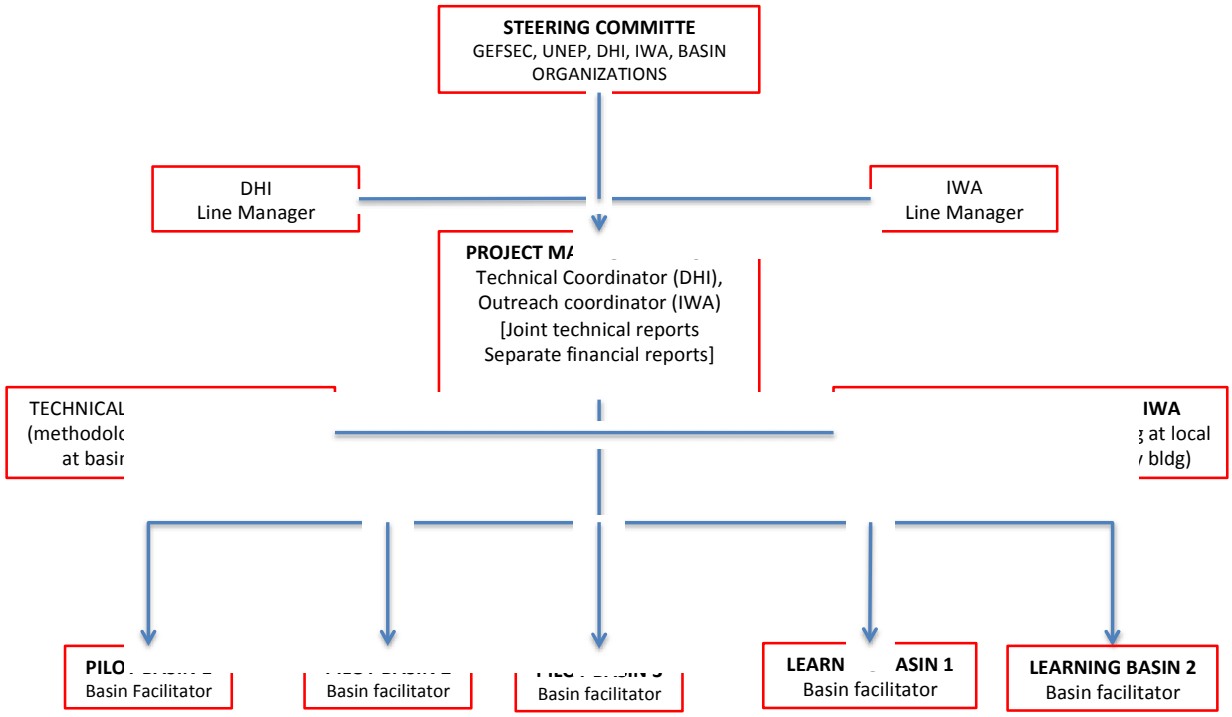
	• External Consultants as required		
Audit	• PMU • External Auditor • UNEP DEPI	4,000	Yearly
Total Indicative Cost - *Excluding project team staff time and UNEP staff and travel expenses*		85,000	

Appendix 8: Summary of reporting requirements and responsibilities

M&E Component Activity	Responsibility Assignment		Means of Assessment/Monitoring Data Source
	Institution/Agency	Project/Agency officer	
Monitoring			
Preparation of Inception Report	PMU Steering Committee in consultation and with approval of UNEP-DEPI	PMU	Project Document Resolutions of the Steering Committee Meetings
Preparation of Progress Reports	PMU Steering Committee in consultation and with approval of UNEP-DEPI	PMU	Project Management Unit's reports
Preparation of Expenditure Statements (including co-financing)	PMU, UNEP-DEPI	PMU	Project Management Unit's reports
Preparation of counterpart contribution reports	PMU	PMU	Project Management Unit's reports
On-site supervision of Project Activities	PMU	PMU	On-site data collection
Workshops	PMU	PMU	Minutes of the Meetings
Executing Agencies Supervision Missions	PMU, DHI, IWA	PMU, task managers of co-executing agencies	On-site data collection Mission reports
Implementing Agency supervision missions	UNEP DEPI	DEPI Task Manager	On-site data collection Mission reports
Evaluation			
Meetings of the SC	PMU, as Secretariat of the Committee	PMU, DEPI Task Manager	Minutes of the meetings of the SC
Mid-Term Evaluation	UNEP DEPI in consultation with PMU	Independent consultant	On-site data collection Consultant report
Final Evaluation	UNEP DEPI in	Independent	On-site data collection

	consultation with PMU	consultant	Consultant report
Project Implementation Review (PIR	UNEP DEPI in consultation with PMU	DEPI Task Manager	On-site data collection PIR reports

Appendix 9: Decision-making flowchart and organizational chart



Appendix 10: Terms of Reference

Steering Committee (SC)

A specific responsibility of the SC will be to facilitate liaison with the GEF Implementing Agency (UNEP) regarding overall governance of the project. The Steering shall:

- Be the decision making body for the project;
- Provide governance assistance, policy guidance and political support in order to facilitate and catalyze implementation of the project, and to ensure relevant project outcomes;
- Annually review program progress and make managerial and financial recommendations as appropriate, including review, amendment and approval of annual reports, budgets and work plans.

Project Management Unit (PMU)

Responsible for the successful implementation project, the PMU will be, where required, guided by the decisions of the Steering Committee, to support the implementation of project outputs through the following tasks:

- Program management (financial, logistical, monitoring and strategic) particularly;
- Assistance in networking with Basin Teams and all participating countries;
- Coordination and oversight of the work carried out by project partners;
- Assistance in implementing basin pilots through guidance and administrative support;
- Maintenance of project information archives- photos, video, documents, outputs, etc,
- Appropriate dissemination and publication of materials and outputs from the project; Capturing lessons learned and disseminating them in appropriate formats (project website and links to IW:LEARN, etc).
- Coordination with the other GEF and non-GEF programs and activities to ensure relevant linkages are made between water projects; and
- Coordination with other international, multilateral and bilateral activities among participating countries related to the implementation of the project, including sourcing additional funding to ensure future sustainability of project interventions.
- Financial reports will be provided separately by DHI and IWA, but there will be joint technical reports from the PMU

The PMU shall consist of the following officers:

- Partners Focal Points – Technical coordinator (DHI) and Outreach coordinator (IWA)
- Administrative and support staff as required from DHI and IWA

Technical coordinator (DHI)

The DHI technical coordinator will work with a technical suppport team in DHI to develop and implement the DSS. The DHI technical coordinator will coordinate the inputs from the technical team developing the DSS in DHI (Component 1 & 2), and will manage technical contributions in components 3 and 4 in cooperation with IWA.

Outreach coordinator (IWA)

The IWA outreach coordinator will work with staff within IWA (outreach support team) on relevant tasks the design and operation of the website, for the organization of consultation and outreach conferences, workshops, and special events and for the production of dissemination materials and publications. The IWA outreach coordinator will mainly coordinate the stakeholder engagement, communication and dissemination (Component 3 & 4), and will manage stakeholder consultations within components 1 and 2 in cooperation with DHI.

Basin Facilitators

Permanent focal points in the pilot basins (basin facilitators) will be selected among existing staff within the executing agencies that are present in the region. IWA will have staff in each of the pilot basins, and (potentially) the learning basins. These staff will have the role of relationship building and to facilitate that the basin visits from the coordinators and technical support teams are productive. The basin facilitators will report directly to the PMU. The PMU will liaise with these contact points to organize meetings, identify stakeholders and implement actions on the ground assisted by short term DHI and IWA staff. For the specific DHI tasks, DHI may interact directly with the pilot basins. In such cases the basin facilitator will be kept informed.

Appendix 11: Co-financing commitment letters

UNITED NATIONS ENVIRONMENT PROGRAMME

Programme des Nations Unies pour l'environnement | Programa de las Naciones Unidas para el Medio Ambiente
Программа Организации Объединенных Наций по окружающей среде | برنامج الأمم المتحدة للبيئة
联合国环境规划署

UNEP

Date: 29th July, 2013

Dear Ms Niamir-Fuller,

As you know, UNEP through its Programme of Work, supports countries, regional management bodies and a variety of national, regional and international partners to promote and strengthen Integrated Water Resource Management (IWRM).

In this context, our Freshwater Ecosystems Unit was especially interested to hear of the UNEP/GEF Project, *"Development of a Methodology with Tools and Decision Support Systems (DSS) to Incorporate Floods and Droughts into IWRM in Transboundary Basins"*. The project, promoted by our GEF IW unit and implemented by DHI and IWA, promises to develop tools to assist our partners in integrating flood and drought management into their ongoing IWRM initiatives.

UNEP is already active in developing Decision Support Systems for transboundary basin management as well as testing methodologies to attenuate floods and droughts in the Volta and Mekong River Basins. We wish to include parts of these initiatives as co-finance to the UNEP/GEF project *"Development of a Methodology with Tools and Decision Support Systems (DSS) to Incorporate Floods and Droughts into IWRM in Transboundary Basins"* under development.

Initiative	Donor or Partner	Period of Activity	Co-finance Pledge
Component 1 of *Adaptation to Climate Induced Water Stress in the Nile Basin*	Sida	2012-2013	$590,000
Review of ecosystem flow regulating functions in the Mekong and Volta Basins	IWMI	February 2013-April 2014	$143,000
		Total:	$733,000

Through these initiatives, we pledge $733,000 in in-kind co-finance to the UNEP/GEF project *"Development of a Methodology with Tools and Decision Support Systems (DSS) to Incorporate Floods and Droughts into IWRM in Transboundary Basins"*.

In addition, UNEP further commits to promoting and disseminating the final products of the project through a variety of forums it hosts or participates in, including: UNEP's Inter-Divisional Water Group (IDWG), UN Water, World Water Forum, Stockholm Water Week, among others.

Ms. Maryam Niamir-Fuller
Director, Division of GEF Coordination
United Nations Environment Programme
P.O. Box 30552-00100
Nairobi, Kenya

Office of the Director
Division of Environmental Policy Implementation (DEPI)
P.O. Box 30552 00100 Nairobi, Kenya • Tel: (254 20) 762 4782/4791/3012
Email: depi@unep.org

We are looking forward to the approval of the project "*Development of a Methodology with Tools and Decision Support Systems (DSS) to Incorporate Floods and Droughts into IWRM in Transboundary Basin*" and to collaborating with this initiative once it is operationalized.

Yours sincerely,

Ibrahim Thiaw
Director

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Dr. Kelly West
Task Manager, International Waters
Division of GEF Coordination
United Nations Environment Programme
PO Box 30552-00100
Nairobi, Kenya

RE: Co-financing commitment-

Dear Dr. West,

The International Water Association (IWA) wishes to express its committement to participate in the implementation of the Global Environment Fund (GEF) funded **Development of a Methodology with Tools and Decision Support Systems (DSS) to Incorporate Floods and Droughts (F&D) into IWRM in Transboundary Basins.** IWA will provide co-financing to the amount of **2,919,842 USD** through a number of ongoing projects detailed below.

Best Regards,

Dr. Ger Bergkamp

Executive Director

International Water Association

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London SW1H 0QS
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Item	Description	Donor	Amount (USD)
Two large scale IWA events 2012-2016	The IWA Congresses will have sessions and themes that provide opportunities for sharing information on floods and droughts methodologies, and provide a platform to promote the project outputs. It costs approximately 500,000 Euros to hold each event such as the IWA World Water Congress and IWA Development Congress and 10% of sessions are relevant to GEF project.	IWA	133,000
Smaller relevant IWA events 2012-2016	At least two smaller IWA events will have a stream on floods and droughts management where project outputs will be highlighted. It costs 200,000 Euros to hold each event and 10% of sessions will be relevant.	IWA	53,200
Project outputs published in a prominent journal(s) and publication(s) 2012-2016	Project outputs highlighted in at least one publications/journals. It costs 10,000 Euros for the cost of production per publication and journal.	IWA	13,300
Partnerships for Capacity Development - Ghana in the ACP Water & Sanitation Sector 2011-2014	Contribute towards improved health of the Ghanaian population in the service areas of Ghana Water Company Ltd. by ensuring high quality, sustainable national water quality testing, monitoring and surveillance. This funding will complement the GEF project by building the capacity to collect relevant data and information to be used in decision support systems especially at the local level.	European Commission	767,144
Water Safety Planning Regional Networks 2013	This funding provides core support to three regional networks in Asia, Africa and Latin America which aim to improve knowledge and expertise exchange on WSP implementation. The networks will be used to facilitate the application of the F&D methodology at utility level as well as integrate into training.	CAPNeT	93,000

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Item	Description	Donor	Amount (USD)
Water Safety Planning East Africa 2011-2016	IWA and USEPA are coordinating a five-year programme to improve the quality of drinking water in 10 East African countries through the implementation of Water Safety Plans (WSPs). The goal of this programme is to establish a sound basis for scaling-up WSP implementation across the region through the implementation of WSPs in ten East-African Countries and creation of long-term supporting mechanisms. The projects will be used to facilitate the application of the F&D methodology at utility level as well as integrate into training.	USEPA	600000
Nexus Dialogue on Water Infrastructure Solutions 2012-2014	The International Water Association (IWA) and the International Union for Conservation of Nature (IUCN) have launched the Nexus Dialogue on Water Infrastructure Solutions, aimed at building partnerships to lead transformations in water infrastructure planning, financing and operation. The Dialogue provides a forum for sharing experiences, lessons, tools and guidelines on how portfolios of water infrastructure and technologies can address the challenges of the nexus. The project will be used to collect relevant information that can be incorporated into the methodology, and provide an opportunity to connect with end users to validate the approach developed in the GEF project	US State Department	297,000

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www.iwahq.org

Item	Description	Donor	Amount (USD)
EU PREPARED 2010-2014	The project PREPARED aims to gather urban utilities in Europe and worldwide that (will) have an advanced strategy in meeting the upcoming challenges for water supply and sanitation brought about by climate change. It provides a framework that links comprehensive research with development programmes in these utilities. The ultimate objective is environmental-concern based rehabilitation and investment programmes for water supply and sanitation systems (including storm water). The cities/utilities involved will be prepared and resilient to the impacts of climate change in the short and in the long-term. The outputs of the PREPARED project can be used to inform the GEF project around approaches being undertaken in cities and utilities to deal with climate change especially floods and droughts.	European Commission	841,198
Operation and Maintenance Network Renewable each year – Co-funding from 2012-2013	The OMN is the reference point for issues related to operation and maintenance (O&M) of water supply and waste water systems in low and middle income countries. It aims to actively promote O&M through comprehensive approaches, Strategic Asset Management, Water Safety Plans and Decentralized Wastewater Treatment Systems. The network will be used to facilitate the application of the F&D methodology at utility level and provide reference material on application (which will enable scaling up).	WHO	117,000
		TOTAL	**2,919,842**

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Dr. Kelly West
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Division of GEF Coordination
United Nations Environment Programme
PO Box 30552-00100
Nairobi
Kenya

Ref:	Init:	Date:
11812178-1	NKN	10 July 2013

Co-financing commitment

Dear Dr. West,

DHI wishes to express our commitment to participate in the implementation of the Global Environment Fund (GEF) funded Development of a Methodology with Tools and Decision Support Systems (DSS) to Incorporate Floods and Droughts (F&D) into IWRM in Transboundary Basins. DHI will provide co-financing to the amount of USD 11.3 mill. through a number of ongoing projects detailed below:

1. **USD 3,600,000 - Development and Deployment of the Nile Basin Decision Support System, Nile Basin (World Bank)**
   To support water resources planning and investment decisions in the Nile Basin, especially those with cross-border or basin level ramifications, DHI was commissioned by Nile Bain Initiative (NBI) to develop and deploy the Nile Basin Decision Support System (NB DSS). The system comprises an information management system, a regional river basin modelling system, and a suite of analytical tools to support multi-objective analysis of investment alternatives. NB DSS will aid the development of core national capabilities to assist in the evaluation of alternative development paths and the identification of joint investment projects at sub-regional and regional levels.

2. **USD 7,295,000 - Development of DSS for Integrated Water Resources Development and Management, India (World Bank)**
   As part of the World Bank project, National Hydrology Project II, DHI was commissioned to develop a generic decision support system (DSS) for integrated water resources planning and management covering nine Indian states and selected central agencies. The solution provided by DHI will help address the following priority concerns: (i) Surface water planning; (ii) Integrated operation of reservoirs; (iii) Conjunctive surface water and ground water planning; (iv) Drought monitoring, assessment and management; and (v) Management of both surface and ground water quality.

3. **USD 2,941,000 - Development of Real-time DSS for Operational Management of Reservoirs of BBMB, India (World Bank)**
   The Bhakra Beas Management Board is responsible for regulating water and power from the Bhakra and Beas reservoirs in Northwest India. DHI was commissioned to implement a tailor made decision support system for sharing water between partner states, optimizing hydropower production, mitigating floods and ensuring sufficient water during drought periods. The solution integrates data and mathematical models into a general IT framework and present key information and forecasts allowing BBMB to operate the dams in a safe, efficient and transparent way.

Best regards
DHI

Antoine Labrosse
Group Chief Executive Officer

EAST AFRICAN COMMUNITY
LAKE VICTORIA BASIN COMMISSION SECRETARIAT

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Our Ref: **ES/WRM-GEF/1/1**
Date: 16th August 2013

Maryam Niamir-Fuller
Director
GEF Coordination
United Nations Environment Programme (UNEP)
PO Box 30552-00100
Nairobi, Kenya

The Lake Victoria Basin Commission (LVBC) is promoting the implementation of Integrated Water Resource Management in the basin in order to support sustainable development and improved socio-economic integration in the region. The LVBC is in the process of developing a Water Resources Information Management System which will include hydrological data, trends in rainfall, and flood and drought information.

The project "*Development of a Methodology with Tools and Decision Support Systems (DSS) to Incorporate Floods and Droughts into IWRM in Transboundary Basin*" to be implemented by DHI and IWA based on GEF funding is of high interest for the Lake Victoria Basin Commission and will complement our ongoing initiatives related to improved water resource management and DSS. In addition, the programme will support other on-going studies and activities that are funded by GEF under the Lake Victoria Environmental Management Project (LVEM II) that aimed at improving collaborative management of the transboundary natural resources LVB for the shared benefits of the EAC Partner States as well as reducing environmental stress in targeted pollution hotspots and selected degraded sub-catchments to improve the livelihoods of communities, which depend on the natural resources of the LVB.

LVBC wishes to express its commitment to participate in the implementation of the above GEF project. The LVBC has a mandate to address and develop activities related to the project activities and will provide in-kind financing of **3 million USD** through complementary activities on transboundary management including:

- **Lake Victoria Water and Sanitation Programme (LVWATSAN II): funded by African Development Bank (AfDB).** The programme is implemented in fifteen towns in all the five East African Partner States within the Lake Vitoria Basin. The overall goal of the programme is to meet the MDG targets in water and sanitation in the project towns and to ensure the long term sustainability of the physical interventions.
- **The Planning for Resilience in East Africa through Policy, Adaptation, Research, and Economic Development (PREPARED) program: Funded by USAID East Africa.** The programme is implemented in all five East African Partner States and aimed at mainstreaming climate-resilient development planning and program implementation into the East African Community (EAC) Partner States development agendas.

- **Lake Victoria Environmental Management Project Phase II (LVEMP II).** The program is implemented in the five EAC Partner States. It is aimed at improving transboundary management of natural resources and addressing environmental challenges in the Basin.

We understand that no additional funding or reporting is required from LVBC in order to participate in above project.

We are looking forward to participating in the project "*Development of a Methodology with Tools and Decision Support Systems (DSS) to Incorporate Floods and Droughts into IWRM in Transboundary Basin*"

Please accept, Madam Maryam Niamir-Fuller the assurance of my highest considerations.

Dr. Canisius Kanangire
EXECUTIVE SECRETARY

AUTORITE DU BASSIN DE LA VOLTA

VOLTA BASIN AUTHORITY

N/Réf. : **13-154/ABV-DE/jwt-az**

Date: 16 July 2013

Bénin- Burkina- Côte d'Ivoire- Ghana- Mali- Togo

Maryam Niamir-Fuller
Director
GEF Coordination
United Nations Environment Programme (UNEP)
PO Box 30552-00100
Nairobi, Kenya

Dear Sir,

The Volta Basin Authority (VBA) promotes the implementation of Integrated Water Resource Management in the Volta basin in order to support sustainable development and improved socio-economic integration in the sub-region. The VBA is presently preparing for the future water resource challenges related to economic development, population increase and climate change. In this context VBA has recently established the Volta Basin Observatory, which will monitor the status and trends of the water resources and the environment of the basin. The information and tools to be generated by the Volta Basin Observatory will assist decision makers in taking well-informed decisions.
The project "*Development of a Methodology with Tools and Decision Support Systems (DSS) to Incorporate Floods and Droughts into IWRM in Transboundary Basin*" to be implemented by DHI and IWA based on GEF funding is of high interest to the Volta Basin Authority and may even further strengthen our ongoing initiatives related to improved water resource tools and DSS.

We hereby confirm that VBA is willing to support the above project by 1) expressing our needs for improved tools and DSS to address the present and expected future challenges in relation to Floods and Droughts, and 2) establishing contacts with relevant national and regional authorities within the basin with the view of testing the mentioned tools and DSS, and 3) contributing to lessons learnt during the testing period (estimated to cover the period 2014-2017) in order to improve the tools and DSS and thus their usability for similar transboundary river basins.

We are pleased to announce that we are presently implementing the following projects:

10 BP 13621 Ouagadougou 10 Burkina Faso Tel: (+226) 50 37 60 67 Fax: (+226) 50 37 64 86
Emails: secretariat.abv@abv-volta.org; secretariat.abv@gmail.com; Web site: www.abv-volta.org

1. "Establishment of the Volta Basin Observatory as a tool for Information, Communication and Decision Support", (198,000 EURO). This forms part of Component 2 of the project "Observatory for Water Resources and Related Ecosystems in the Volta Basin, funded by AFD for an amount of (€1 200 000). Implementation period: 2009-2014
2. "Volta-HYCOS Project". Funded by African Water Facility (€1 200 000). Implementation period: 2010-2014
3. " Appui au renforcement des capacités de l'ABV Phase2". Funded by EU, AFD and others partners (€450.000). Implementation period: 2012-2016.

These projects are equally addressing IWRM in the transboundary Volta basin and they can be considered as our in-kind contribution for the cooperation with the above-mentioned GEF funded project.
We understand that no additional funding is required from ABV and no additional reporting is required by ABV in order to participate in above project.

We look forward to participating in the project "*Development of a Methodology with Tools and Decision Support Systems (DSS) to Incorporate Floods and Droughts into IWRM in Transboundary Basin*"

Yours faithfully,

Dr. Charles A. Biney
Ag. Executive Director

AUTORITE DU BASSIN DE LA VOLTA
ABV
Tél 50 37 60 67
10 BP 13621 Ouaga 10

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Maryam Niamir-Fuller
Director
GEF Coordination
United Nations Environment Programme (UNEP)
PO Box 30552-00100
Nairobi, Kenya

The Hydro and Agro Informatics Institute (HAII) is promoting the implementation of Integrated Water Resource Management in the Chao Phraya River Basin in order to support sustainable development and improved socio-economic integration in the sub-region. HAII is presently preparing for the future water resource challenges related to economic development, population increase and climate change. In this context HAII has established a dense telemetry based hydrological monitoring network, Numerical Weather Prediction models and is combining these observations and weather forecasts with advanced water allocation and Flood Forecasting Modeling.

The project "*Development of a Methodology with Tools and Decision Support Systems (DSS) to Incorporate Floods and Droughts into IWRM in Transboundary Basin*" to be implemented by DHI and IWA based on GEF funding is of high interest for the Chao Phraya River Basin Authorities and may even further strengthen our ongoing initiatives related to improved water resource tools and DSS.

We hereby confirm that HAII is willing to support the above project by 1) expressing our needs for improved tools and DSS to address the present and expected future challenges in relation to Floods and Droughts, and by 2) establishing contact to relevant national and regional authorities within the basin in view of testing the mentioned tools and DSS, and finally by 3) contributing to lessons learnt during the testing period (estimated for the period 2014-2017) in order to improve the tools and DSS and thus their usability for similar transboundary river basins.

We are pleased to announce that we are presently implementing the following projects:

1. "Flood Modeling and Management for greater Chao Phraya River Basin". Funded by Minister of Science and Technology (717,000 EURO). Implementation period: 2012 - 2013

These projects are equally addressing IWRM in the Chao Phraya River Basin and they can be considered as our in-kind contribution for the cooperation with the above mentioned GEF funded project. We understand that no additional funding is required from HAII and no additional reporting is required by HAII in order to participate in above project.

We are looking forward to participate in the project "*Development of a Methodology with Tools and Decision Support Systems (DSS) to Incorporate Floods and Droughts into IWRM in Transboundary Basin*"

Bangkok, 29 July, 2013

Royol Chitradon

Dr. Royol Chitradon
Director of Hydro and Agro Informatics Institute

Dr. Kelly West
Task Manager, International Waters
Division of GEF Coordination
United Nations Environment Programme
PO Box 30552-00100
Nairobi, Kenya

Ref: 12137

Vienna, 3 July 2013

RE: Cofinancing Commitment

Dear Dr. West,

The International Commission for the Protection of the Danube River (ICPDR) wishes to express its committement to participate in the implementation of the Global Environment Fund (GEF) funded **Development of a Methodology with Tools and Decision Support Systems (DSS) to Incorporate Floods and Droughts (F&D) into IWRM in Transboundary Basins.** The ICPDR has a mandate to address and develop activities related to the project activities and will provide both in-kind financing to the project and the possibility of direct financial support for specific actions depending upon the finalization of the project activities and the link of those activities to planned initiatives of the ICPDR. It is assumed that these direct financial and in-kind contributions could be significant and exceed 500,000 Euros. In particular, the ICPDR is committed to utilize the meetings of the Flood Expert Group of the ICPDR involving all Danube countries to be a forum for discussion and dissemination of project activities.

The ICPDR is currently undergoing a transitional period (change of Executive Secretary) and revised programme planning and following the completion of this in fall of 2013 a more specific commitment can be delivered to the project.

Please be assured, however, that the planned project is both of strong interest to the ICPDR and the ICPDR has a commitment to further develop activities and actions in this field which could both benefit from the Project and provide benefit to the project.

Sincerely,

signed

Philip Weller

Executive Secretary

ICPDR Secretariat / Vienna International Centre, D0412 / P.O. Box 500 / 1400 Vienna / Austria
Phone +43 1 26060-5738 / Fax +43 1 26060-5895 / icpdr@unvienna.org / www.icpdr.org

Appendix 12: Endorsement letters of GEF National Focal Points

Endorsement letters are not applicable for this global methodology project, however, participating basins have shown their support and commitment for the project through their co-finance letters included in the previous annex.

Appendix 13: Draft procurement plan

IWA Procurement procedures
In general all processes leading to the commitment of IWA to get goods or a service from third parties ending with an invoice or another legal relationship are covered by this procedure.

This procedure has to be used by all IWA entities world wide like IWAHQ, IWAP, Business Units and related companies, local offices.

General:

- Staff should be aware that expenditure is committed when an order is placed on behalf of IWA and not when an invoice has been received. Therefore, it is important that all orders are placed according to the procedures as laid out below, and within the agreed budget and delegated powers.
- The Purchase Order System (POS) is the system used by everybody working with this procedure. The working of the system is assumed to be known by everybody. All activities ending with an invoice should be in the POS

The process consists of four different stages:

Plan: The process of preparing the contract / order with the formal approval
Any order or contract should be in line with the activities as stated in the Business Plan. If this is not the case, for an expenditure (defined as above) of more than £1,000 / €1,250 but less than £20,000 / € 25,000 separate authorisation has to be obtained by the Controller, C.O.O or E.D / Managing Director IWAP.

For expenditures above £20,000 / €25,000 and not within the Business Plan, additional authorisation by the Executive Director / Managing Director IWAP and Treasurer needs to be sought.

Budget holders can place orders for goods or services within their budget areas. Orders above £20,000 / € 25,000 are to be approved by the Controller for cash-flow reasons.
All orders of £1,000 / €1,250 or more must be authorised by the budget holder. For orders under the value of £1,000 / €1,250, the budget holder may delegate the authority to order. Any such delegation of authority should be advised to the Financial Controller who keeps a register of the authorized persons.

A tender procedure is always needed if a contract/order is > £1,000 / €1,250. At least two proposals from different suppliers are needed. If the order is > £200,000 / €250,000 a European tender is obligatory.

Do: The process of concluding a contract/order and execute the contract /order

An order is for a one time deliveries of (standard) goods. For all other purchases a contract is to be made. Orders > *£1,000 / €1,250* should always be placed in writing. Contracts are always in writing.
Cash payment, more then £50 / €60, needs approval by the Finance department before conformation of the agreement. Expenditure for small items (<£50 / €60) go through petty cash.

The expenditure for a contract is defined as the total over contract period or first 12 months if contract is open ended.
Contracts always need the advice from the C.O.O. who can decide to ask professional advice (accountant, solicitor e.g.)

The Finance department holds a Contract Register with all contracts and files all original contract documents in London.

All orders and contracts are to be entered into the Purchase Order System. Without this entry budget proper liabilities and budget reporting and payment of invoices will not take place.

Control: The process of controlling the order/contract during its life time

Terms & conditions should be according to the IWA standard terms (to be described : payment period at least 30 days, description of specification and quality goods, other payment terms like currency, delivery time and place etc.).

In case of any form of prepayment it needs to be ensured that the Finance department has approved the prepayment and the supplier offers guarantees. Suppliers have to produce invoices or pro forma (in case of payment in advance)

Upon delivery the person ordering the goods or services checks whether delivery is according to specifications. The findings are recorded in the POS. If there are no queries the invoice will be paid in line with terms & conditions.

Act: The process of finalizing and learning
If there are no queries the invoice will be paid in line with terms & conditions.
Queries regarding payment will be forwarded to the budget holder if no records are available in the POS.

The F.C. keeps a contract register and files contracts *(*hardcopy and digitally on the shared server).

Learning points should be taken from queries in all stages of ordering, delivery and invoice payment. At least once a year the Controller reviews the procedure and reports his findings to FIC and IWA Management.

Each process stage has its own characteristics and is described below..

Definitions used are:

- ‘Order’ : can be read as order, contract, lease agreement, service agreement
- F.C. : the Financial Controller of IWA
- Finance: the employees of the finance department in London

Not included in this procedure are

- Contracts with employees
- Contracts for the delivery of goods or services by IWA to third parties

DHI Procurement procedures

DHI works in accordance with the quality management system standard: ISO 9001 as certified by DNV. The certificate is covering consulting, software, research & development and laboratory testing, analysis & products within the area of water, environment & health

It is not planned that DHI will purchase equipment or hire sub-consultants during this project, but if required the procedures as presented below will be followed:

This page describes the procedures for entering into a subcontract.

The scope and program for the required services must be defined and a suitable subcontractor identified based on his proven performance in delivering similar services in a professional and cost efficient manner.

Services from other DHI business units must be agreed based on the principles and rules laid down in the Inter-company Trading Agreement (ITA) (see Annex 3), using the Internal Services Agreement (ISA) template available from the contract material library on the SharePoint project and opportunity sites, respectively.

Control of proven performance of an external subcontractor previously contracted by DHI is done in Maconomy. It is controlled that the subcontractor has been registered for delivery of the same type of services within the last 2 years. If this is not the case a new assessment must be made.

For a subcontractor not contracted by DHI within the last 2 years the ability to deliver the required services must be assessed from e.g. project references, CVs, certifications and accreditations relevant for the required services. Material used for the assessment must be saved in the contract material library on the SharePoint project site.

Subcontracts must be approved and signed in accordance with the provisions regulating the power to bind DHI.

For contracts which include accredited analysis and test, the use of subcontractors must be communicated to and approved by the customer.

The main expenditures to be administered by DHI will be travel costs. The policy of DHI is that travelling shall be done at “economy class” and the most cost-effective travel schedule shall be selected. DHI has approved two travel agents where tickets can be bought if not found cheaper elsewhere.

Appendix 14: Tracking tool

Not applicable to this global tool-methodology development project

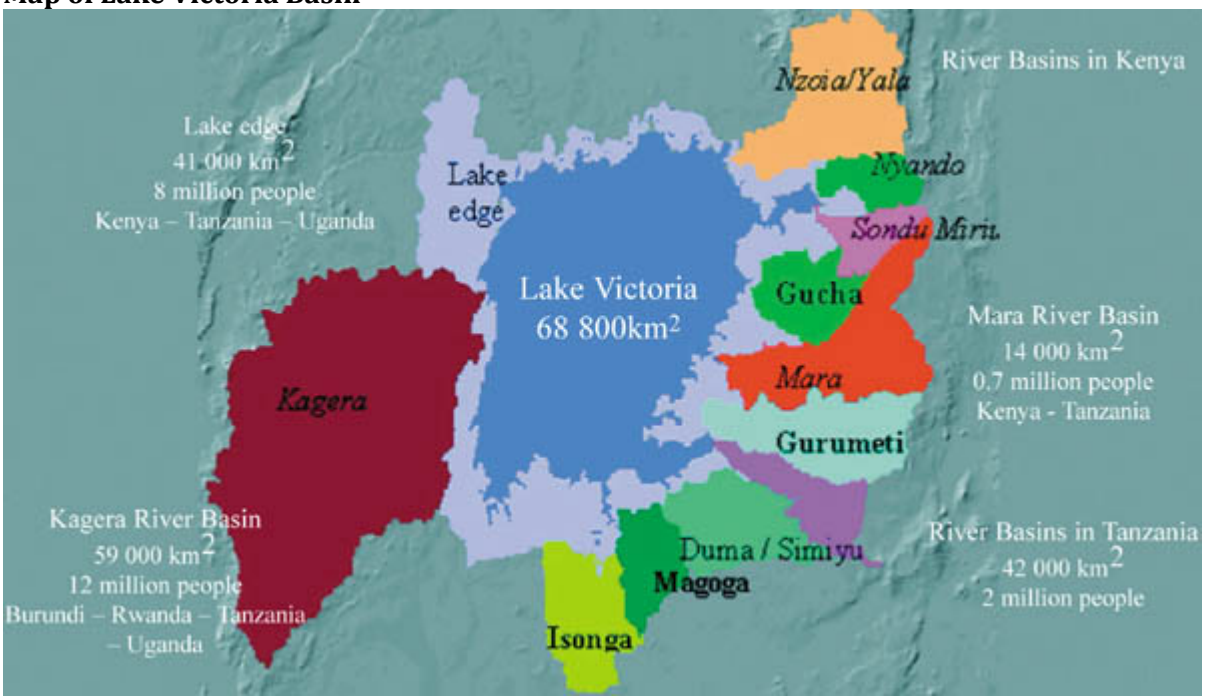
Appendix 15: The Pilot basins

Lake Victoria Basin - Overall features

Physical characteristics and climate

The Lake Victoria Basin is shared among 5 states: Tanzania has a catchment area of 44% (85,448 km²), Kenya 22% (42,724 km²), Uganda 16% (31,072 km²), Rwanda 11% (21,362 km²) and Burundi 7% (13,594 km²). The lake surface (68,800 km²) itself is shared among Kenya (6%), Uganda (43%) and Tanzania (51%). Lake Victoria is a sub-basin of the Nile Basin. Lake Victoria Basin falls under the equatorial hot and humid climate with a bi-modal rainfall pattern with long rains from March to May and short rains from October to December. Annual rainfall varies from a max. of 2400 mm in Uganda to 1,350 mm in the Kenyan part of the catchment.

Map of Lake Victoria Basin



Socio-economics

The Lake Victoria Basin has a population of about 35 million people (2005) with a rural proportion of 60%. If Kampala is disregarded, rural population varies around 90%. National growth rates varies between 2% in per annum in Burundi to 3.4% per annum in Uganda. On the average 65% of the population is under 25 years which implies a high dependency level. Population density is 350 persons/km², which is relatively dense for the region (up to 1200 persons/km² in parts of Kenya). This is due to its favorable conditions for agriculture, fishing and other economic activities. The vast majority of the population depends on natural resources and small holdings of one hectare or less. Agriculture and fisheries are the two most important livelihoods. Other economic activities include bee keeping, trading activities, quarrying and sand mining and mining of gold and other minerals. Agrochemicals production and food processing are also among the important economic activities.

Hydrology, floods and droughts

About 33% of the inflow to the lake comes from Kagera River, shared between Rwanda, Burundi, Uganda and Tanzania, while Mara River (5%) is shared between Kenya and Tanzania. Other notable rivers are Nzoia (15%) and Yala (5%) in Kenya. The total average inflow to the lake is about 800 m^3/sec.

Basin-wide, floods and droughts have been characterized as serious issues with root-causes for floods being irregular seasonal and year to year variability in rainfall patterns, increased climatic changes, mismanagement of land and water resources leading to soil erosion and increased run-off. Root-causes for droughts are long and pronounced dry seasons due to e.g. climate changes manifested by conditions such as El Ninô and La Nina.

Hydraulic infrastructure
The most important hydraulic structure in the basin is the Owen Falls Dam at Jinja, at the outlet from Lake Victoria. This dam is built for hydropower generation and will in the near future be supplemented by one more dam straddling the Nile downstream of Owen Falls near Bujagali. The dam at Owen falls is operated in such a way that it releases the "natural flow" of the Nile.

Institutional environment
At the regional level, Lake Victoria Basin Commission was established in 2005 as an apex institution of the East Africa CommunityThe Commission functions in the countries through the designated National Focal Point Ministries and the Ministries responsible for East African Community Affairs. LVBC coordinates the sustainable development of the Lake Victoria Basin as well as programs and other interventions undertaken by various stakeholders operating in the basin. LVBC has outlined a number of strategies to reduce the environmental pollution of Lake Victoria and improve the living conditions of the increasing number of people living in the Lake Basin. These include, improved waste management, both solid and liquid, expanded water supply coverage in both urban and rural areas, and better environmental sanitation.

Key issues
The key issues in the basin are, land use and land degradation, biodiversity and fisheries decline, water quantity (incl. floods and droughts) and water balance, water quality and pollution, socio-economic and cross-cutting issues in relation to poverty.

Droughts and floods contribute to the most devastating natural hazards in the basin, which often translate into disasters in the riparian countries. Floods are attributed to the heavy rainfall over the catchments upstream; rivers often burst their banks and submerge communities resulting in displacement of people and destruction of homes and livelihoods. Droughts in the basin affect food production, availability of water, and generation of hydroelectric power for industrial and domestic consumption.

Projects and programs
One of the key programmes in the basin is the Lake Victoria Environmental Management Program (LVEMP I) and an extension into LVEMP II. Presently, a Decision Support System for the full Nile Basin is under deployment. The system has been developed under the Nile Basin Initiative under the umbrella of the Water Resources Planning and Management Project headquartered in Addis Ababa. The Project has made significant progress in project management training; development of the regional Decision Support System (DSS) and establishing national level DSS focal points and; initiating work on the technical, institutional and financial sustainability of the DSS. It has also supported the NBI Secretariat in preparing data and information sharing procedures and guidelines, as well as initiating the development of the Basin Monitoring Strategy.

Another key programme includes the **Lake Victoria Region Water and Sanitation Initiative phases 1 and 2,** which was initially launched in 2004 by UN-HABITAT, in association with the Governments of Kenya, Tanzania and Uganda to address the water and sanitation needs of the population, particularly the poor, in the secondary urban centres around Lake Victoria. Funding is from a variety of donors including the African Development Bank. The first phase was aimed at small towns in Uganda, Kenya and Tanzania, and the second phase involves 15 additional towns, some of those in Rwanda and Burundi.

A regional initiative funded by USAID is the Sustainable Water and Sanitation in Africa (SUWASA) which is designed to spread effective models of reform at the water utility and sector levels, and to facilitate innovative financing approaches for African water providers. There is special consideration of improving and expanding the delivery of water and sanitation services in urban and peri-urban settings. Projects are implemented in a number of countries including Kenya and Uganda.

Urban environments and utilities

Overview of urban areas in the basin

The majority of the population in the basin lives in rural villages and small towns. However, the region has experienced a process of rapid urbanization over the recent past with the towns, many of which are concentrated along the lake edge, growing at rates far in excess of the regional average of 3% per year. The urbanization process has been accelerating due to several factors, including rural poverty, land pressures and lack of job opportunities in the rural areas.

There are 87 large towns in the Lake Victoria Basin (51 in Kenya, 30 in Tanzania and 6 in Uganda). The major urban areas directly on Lake Victoria lakeside include Mwanza, Bukoba, Musoma, Kampala, Entebbe, Jinja, Masaka, Kisumu, Homa Bay, and Kendu.

Country	**City**	**Population**
Kenya	Kisumu	427,000
	Homa Bay	59,528
	Kendu Bay	29,638
Tanzania	Bukoba	105,000
	Musoma	104,851
	Mwanza	385,810
Uganda	Kampala	1,659,600
	Entebbe	79,700
	Jinja	89,700
	Masaka	74,100

These cities and towns are a pollution source in the Lake Victoria Basin due to inadequate solid and liquid waste handling capacity by urban centres. A study by COWI Consulting Engineers indicated that the pollutant loading to the lake from urban areas was 17,938 tons/year of Biochemical Oxygen Demand (BOD), 3,505 tons/year total Nitrogen, and 1,624 tons/year total Phosphorus. The flow of nutrients and effluents from urban sources (as well as from deforestation and agriculture) has resulted in increasing eutrophication near the lakeshore. Poor water quality means that the inhabitants of the towns and cities surrounding Lake Victoria suffer from a shortage of clean and safe, fresh drinking water.

Major Utilities in the Basin
The largest utilities are those in Kisumu (Kenya), Kampala (Uganda) and Mwanza (Tanzania).

In Kenya, Regional Water Boards have the responsibility for provision of water supply. In the Lake Victoria area in Kenya, the board is the Lake Victoria South Water and Sewerage Board (LVSWSB). In Kisumu, the LVSWSB appointed Kisumu Water and Sewerage Company (KIWASCO), a publically owned company, to supply water within the jurisdiction of Kisumu municipality. Most of the water in Kisumu is obtained from Lake Victoria. Kisumu's water supply facilities have a design capacity of 22,700 m3/day, Sixty five percent of Kisumu residents have access to an improved water source, while 35 percent rely on unimproved water sources, including water vendors, open wells/springs, streams and ponds.

The National Water and Sewerage Corporation (NWSC) is the primary supplier of water and sanitation services for Uganda including Kampala, withdrawing water from Lake Victoria (NWSC 2010). It is owned by the Uganda government and currently serves twenty three towns, which represent the largest urban centres within Uganda serving 2.9 million people out of approximately 32 million. NWSC is an IWA Governing Member.

The Mwanza Urban Water and Sewerage Authority (MWAUWASA) is the Government agency established for provision of Water and Sewerage Management Services in the city of Mwanza, Tanzania. Lake Victoria is the major source of the piped water scheme, which serves about 84% (500,000 people) of the Mwanza City and Kisesa township population. The rest of population obtains water from shallow, medium/deep wells, rivers and traditional water sources. Sewerage coverage is extremely low, and the current system only serves 35,000 people and covers about 8% of the city water supplied service area.

Water Safety Plan Implementation Status
In Uganda, NWSC has established WSPs for the 23 large towns with varying levels of complexity. Out of 137 urban centers with piped water supplies, 114 small towns do not have WSPs. The rural populations (27 million) are served mainly by point water sources such as boreholes, protected springs and shallow wells with no WSPs. Some challenges related to implementing WSPs in Uganda are inadequate capacity of the private water operators, inadequate documentation of the system, lack of record keeping, problem in finding skilled team members, team members taking on additional roles on voluntary basis was an issue maintaining a constant composition of trained team members and identifying willing external stakeholders and engaging them, Godfrey et al. 2003.

KIWASCO and MWAUWASA currently have no formal WSP in place.

Management of floods and droughts in urban areas
Lake Victoria basin is prone to floods in the low lying areas of the basin during the rainy season where water reaches peak levels and rivers overflow their banks. Heavy sediment loads brought down by rivers from deforested upstream areas decreases the carrying capacity of the rivers and consequently generates rise in flood levels. In some years, the lake rises to unexpected levels when the major rivers reach their peaks flowing back on to the lands to enhance flooding in lowlands, threatening houses, infrastructure, agricultural lands, crops, and causing fatalities of humans and livestock.

In regards to droughts, there has been improvement in recent years in the seasonal and long-term climate predictions, such as those issued by many national and regional institutes in Africa, including the Drought Monitoring Centres have assisted in the implementation of drought disaster mitigation and effective contingency plans.

Information on how utilities and urban areas are managing floods and drought situations is limited. In Mwanza, MWAUWASA has needed to make major change in their abstraction system due to a reduction in lake levels. They have constructed a new sump which is lower than the original, and added more pumps to enable pumping of water to the treatment plant from the new sump.

Interaction between Water Utilities and LVBC

Interaction between utilities and the LVBC takes place through various projects including LVWATSAN. This initiative is managed through the LVBC and utilities in the participating towns are cooperating with LVBC to meet the MDG targets in water and sanitation in the project towns and to ensure the long term sustainability of the physical interventions.

Data and information availability

Basin data including data on surface water, groundwater, floods and droughts are found with the national water resources authorities and to a lesser degree with LVBC. DHI is contracted by LVBC to prepare a Water Resources Information System (WRIS). In Uganda, water resources data are found with the Directorate of Water Resources Management, in Kenya data are found in Water Resources Management Agency and in the catchment authorities, in Tanzania in Ministry of Water & Livestock and in particular in the basin water boards. Rwanda's water resources data are found with the Ministry of Natural Resources while Burundi's data are found in Ministry of Water, Energy and Mining with the Directorate General for Water and Energy. Both in Burundi and Rwanda several institutions overlap as regards water resources data and fragmentation is present.

The LVBC Water Resources Information System (WRIS) is developed on the same platform as the Nile Basin DSS, and customised with a specific Graphical User Interface for the client profiles in LVB, and with an array of specific data capture, analysis and publishing tools. The LVBC WRIS will also include a web portal for interactive sharing of information to stakeholders in LVB. Most of the tools developed under the LVBC project will be included in future upgrades of the Nile Basin DSS under the service and maintenance contract with NBI.

GEF past and present involvement in basin

Through the World Bank as implementing agency, the GEF has invested significantly in foundational projects totaling about US $45 million, with more than $150 million in additional leveraged resources. A TDA and SAP (dated 2007) have been produced, identifying key priorities in the following areas:

- *Ecosystems, Natural Resources and Environment*
- *Production and Income Generation*
- *Living Conditions and Quality of Life*
- *Population and Demography*
- *Governance Institutions and Policies*

Climate change, related to the lake's water balance with specific mention of floods and droughts, is a priority transboundary issue identified within the Ecosystems, Natural Resources and Environment cluster, though specific actions in this area are not elaborated.

Key contacts

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Chao Phraya Basin - Overall features

Physical characteristics and climate

The Chao Phraya Basin in Thailand covers an area of 159,000 km^2 and is the most important basin in many respects. It covers 30% of Thailand's land area, is home to 40% of it's population and generates 66% of its Gross Domestic Product. It stretches from the slightly elevated northern plains, through the central plains and ends in the low alluvial plains where the river reaches the Gulf of Thailand, which is an international water body shared between Thailand and Cambodia. The Gulf of Thailand connects to the South China Seas and the Pacific. The climate is a wet monsoon climate with a rainfall between 1000 mm in the west and 2000 mm in the east. Temperature varies between 24^o C and 33^o C. The monsoon occurs May to October.

Map of Chao Praya Basin

Socio-economics

The total population of the Chao Praya basin is about 30 mill inhabitants. Around 50% lives in the lower part of Chao Praya basin in which Bangkok is situated. Similarly there is a large population concentration

in the upper Ping area where Chiang Mai is located. Overall, about 68% of the total population of the basin is rural. The basin can be divided into a prosperous north and south and a poor middle reflected in the socio-economic conditions. The Gross Provincial Product and economic growth rates vary considerably depending on the industrial and agricultural shares in the provincial economies. High growth sub-basins are industrial and low growth rate basins are agricultural. Although Thailand is considered to be economically relatively advanced, rural people are still poor with average incomes of close to 1000 USD/year. Typically there is about a six-fold difference in average per capita income between the citizens of the Bangkok and those in the rural areas.

Hydrology, floods and droughts

The headwater of the Chao Praya river originates in the northern part of the country and consists of four tributaries, Ping, Wang, Yom and Nan rivers. In the downstream part the Chao Praya river splits into four channels of which Chao Praya is the one which is passing through Bangkok. Chao Praya at Nakhon Sawan (the upper confluence) has an annual average flow of 718 m^3/sec and a max flow of 5960 m^3/sec.

Floods are a regular feature of the Chao Praya basin and cause significant economic losses. Floods have been aggravated by; the decline in flood retention areas and the confinement of flood plains due to increasing development; and rapid urbanization in the vicinity and intensification of agriculture. Droughts are occurring in the dry season and salt water can intrude as far as Ayuttaya, 100 km from the coast.

Groundwater in the basin has a safe yield 2,800 mill. m^3/year. It offers a god quality source for instance for domestic supplies. About half of Bangkok's water supply comes from unsustainable groundwater extraction and the problem is spreading.

Hydraulic infrastructure

Since 1950 more than 3,000 dams have been constructed in order to store the monsoon flows to explore the agricultural potential during the dry season. The two largest dams are Bhumipol and Sirikit Dams which together control 22% of the runoff from the area of the entire basin. Together the installed hydropower capacity of these two dams is 1200 MW. There are also a number of barrages on the main stream diverting water for irrigation schemes.

Institutional environment

The water institutional environment in Thailand is complex with a plethora of government agencies involved in managing water resource development, use and delivery. The principal boards and committees responsible for developing policies concerning water resource development, management and conservation are the National Economic and Social Development Board (NESDB), the National Environment Board (NEB) and the National Water Resources Committee (NWRC). These institutions often have overlapping responsibilities. At the provincial level, the Provincial Administration and District Administration offices (and similar agencies at the local government level) have an operational role in supplying local domestic and industrial water, but in reality have little role in water resource planning and management at the basin level.

The Royal Irrigation Department (RID) is the agency responsible for development of irrigation systems in Thailand mainly from surface water, but supplemented from groundwater. Pumped irrigation schemes are being implemented by the Department of Energy Development. Department of Water Resources is responsible for a variety of project in relation to water resources use, conservation and protection, while the Electricity Generating Authority operates a number of dams both hydropower dams and multipurpose dams. Bangkok Metropolitan Administration is responsible for the canal and drainage system in the Bangkok area. There are plans to improve capacity of existing government bodies and organizations concerned with water management. The Science and Technology Minister foresees that eventually

Thailand will establish a water resource ministry. Likewise there are intentions to strengthen river basin management in 25 designated basins.

Key issues
The key issues in the basin include: encroachment on forest areas clearing for agriculture, watershed degradation, soil erosion and sedimentation, poor surface water quality due to industrial, domestic and agricultural discharges, increasing groundwater pollution, floods and flood mitigation, droughts and storage for drought mitigation, unsustainable groundwater use, water scarcity, low efficiency of water infrastructure, pollution of canals and water courses during and after floods. Overpumping of groundwater near Bangkok leads to land subsidence and eventual flooding.

Projects and programs
The Thai government is to implement massive water resource projects countrywide costing 350 billion baht to permanently solve flood problems in accordance with three blueprints from the Office of National Water Resources and Flood Prevention, Science and Technology Ministry.
Reports outline comprehensive and sustainable water resources development along the Chao Phraya river for eight projects worth 300 billion baht, 17 projects along small rivers and tributaries in the Northeast and six projects in the South worth a combined 50 billion baht.

The projects include; watershed forest restoration in the North covering 16,000 km2, forest development in the Central Plain, reservoir construction on northern rivers with a capacity of 2 km3, reservoirs for irrigation on Yom river with a capacity of 1.2 km3, land use planning including building flood walls around highly concentrated communities and economic centres in provinces prone to floods, turning the irrigated farmland above Ayutthaya and Nakhon Sawan into temporary water retention areas; improve the water flow of the main rivers by dredging silt, protecting riverbanks and digging adjoining canals, improvement of databases on weather forecasting and warnings as well as water resource management for both drought and flooding.

<u>Urban environments and utilities</u>
Overview of urban areas in the basin
Bangkok and its vicinity have the highest population density, with 1,497 person/km2 and a population of more than 14 million. Chiang Mai, which is the second largest city in Thailand, is also in the Basin

City	**Population**
Bangkok Metropolitan Area	14,565,547
Chiang Mai (Metropolitan Area)	960,906
Lampang	58,915
Nakhon Sawan	93,141
Nonthaburi	262,158
Phitsanulok	77,381

Water supplies for domestic purposes are provided by water service facilities in urban areas and by wells in rural areas. At the provincial level, domestic water supply coverage is about 47% of all households.Only 12% of domestic water supply in urban areas is from groundwater sources. Total domestic water requirements in 1993 were estimated at 3,194 Mm3 per year.

Water Utilities
Across Thailand, potable water supplies are generally provided by two agencies: the Metropolitan Waterworks Authority (MWA) and the Provincial Waterworks Authority (PWA). The MWA engages in

production and distribution of potable water in the Bangkok metropolitan region while the PWA is responsible for all provinces in Thailand. The PWA is also responsible for water resource development, conveyance, pumping, treatment, and storage and distribution facilities from all urban and rural communities in the provinces. MWA is a corporate member of IWA. Another relevant corporate members is the Thai Waterworks Association.

MWA is a state enterprise under the Ministry of Interior and provides good quality water supply to residences, businesses, and industries in Bangkok, Nonthaburi, and Samut Prakan. Chao Phraya river and Mae Klong river are the sources. Despite considerable expansion of the distribution system, MWA is still able to supply only 43% and 66% of the population with piped water; the peri-urban areas at the edge of Bangkok are not fully serviced. MWA is responsible for the quality control in the distribution process in which it carefully tests the distributed water in every service area. They strictly follow the WHO's standard, i.e., making not less than one sampling per 10,000 consumers.

Water Safety Planning in the Basin
MWA does not have a water safety plan; rather they use a risk management approach. However, a committee has been set up by the MWA deputy governor to establish water safety planning.

Interaction between water utilities and basin organizations
MWA has been appointed to sit on the committee of Mae Klong river basin. Since WSPs are not common in Thailand, the Basin authorities are not unaware of the process but do use risk management approaches.

Management of floods and droughts in urban areas
The Thai government controls floods through the construction of multi-purpose reservoirs, dikes (diversions) and other flood control infrastructures which are expensive for the country and can still fail. This containment strategy has resulted in a higher overall flood risk as water elevation levels are reached more quickly. There are various plans and activities in the upper and lower parts of the basin, in particular protecting all industrial parks which were greatly impacted in the 2011 floods, leading to lost production and revenue. In addition, the Japanese International Cooperation Agency (JICA) is assisting in training MWA scientists and engineers in technical collaboration on risk management.

Flooding affects the turbidity of raw water to the MWA; there is especially high turbidity 1-2 weeks in a year. Furthermore, during 1 to 3 weeks per year, raw water quality is affected by high organic from the fermentation of agricultural crops during flood events. Severe flooding, such as in 2011, has a significant impact on water utilities especially the increase in pollution levels of the raw water. The MWA needed to adopt new measures to mitigate high level of organics by increasing chemical treatment 4-6 fold, as well as introducing other treatment mechanisms such as using ozone.

Data and information availability
Basin data including data on surface water, groundwater, floods and droughts are primarily found with the Department of Water Resources, the Royal Irrigation Department, Thai Meteorological Department, Department of Groundwater Resources and Hydro and Agro Informatics Institute (HAII).

GEF past and present involvement in basin
As a national basin, the Chao Phraya has not received dedicated project assistance from the GEF. It is however part of the South China Sea drainage basin and directly linked to the Gulf of Thailand, which is the subject of various UNEP, UNDP and WB interventions supported by the GEF.

Key organizations and contacts in Chao Phraya River Basin

Organisation	***Responsibility***	***Contact***
Department of Water Resources (DWR):	DWR is responsible for a variety of projects and carries out projects in relation to water resource management (MIKE BASIN type) and real-time flood forecasting (MIKE 11 type). They have information in relation to these projects.	Name: Kunpot Buatone Email: khunphot@gmail.com
Royal Irrigation Department (RID)	RID is responsible for operation of RID reservoirs and operation of canal/river structures. RID operate also monitoring networks for registration of water level and discharge in river and canal systems as well as rainfall gauges. RID will have many other information operations about canal /river systems e.g. cross section data, digital elevation models for the basin, information about irrigation schemes etc.	Name: Mr. Thada Sukkapunnapan Email: thada999@yahoo.com
Bangkok Metropolitan Administration (BMA)	BMA is responsible for the canal and drainage system in the Bangkok area.	Name: Mr. Sunsern Ruengrit Email: sunsernr@gmail.com , sunsern@bangkok.go.th
Electricity Generating Authority Thailand (EGAT):	Responsible for operating a number of major dam in the Chao Phraya river basin, e.g. Bhumibol and Sirikit Dams. These dams are multi- purpose dams used for hydro power as wells as water supply for irrigation and municipalities. EGAT collects data relevant for reservoir operation and has also a number of rainfall gauging stations	Name: Mr. Maitree Foitong Email: maitree_f@egat.co.th
Thai Meteorological Department (TMD):	TMD collects meteorological information within the Chao Phraya river basin.	Name: Mr. Somchai Baimuang Email: somchaib@tmd.go.th
Land development Department (LDD):	LDD has integrated the IT solution to support management and decision - making in soil and land databases. LDD builds and operates GIS database and implement GIS applications. Standard application softwares includes soils, land use / land cover, permanent forest that greatly enhance the value	Name: Mr. Paitoon Kadeethum Email: paitoon@ldd.go.th

	of investment in base maps and other data.	
Department of Groundwater Resources:	Geological and hydrogeological data, groundwater abstraction data	Name: Dr. Oranuj Lorphensri Email: oranujl@hotmail.com
Hydro and Agro Informatics Institute (HAII):	Hydro and Agro Informatics Institute has continually developed technology and best practices in agricultural and water management by gathering essential data and information on water resources in Thailand in collaboration with both government and private agencies. HAII is responsible for a Flood Forecasting and Flood Management DSS for Chao Phraya River Basin.	Name: Dr. Surajate Boonya-Aroonnet Email: surajate@haii.or.th

Key contacts within water utilities

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Metropolitan Waterworks Authority - http://www.mwa.co.th

Volta Basin - Overall features

Physical characteristics and climate

Map of Volta Basin

The Volta Basin covers an area of about 400,000 km² of the sub-humid to semi-arid West-African savannah zone. It is the 9th largest basin in Sub-Saharan Africa, falling within six countries; Benin, Burkina Faso, Côte d'Ivoire, Ghana, Mali and Togo (see Table 1). The Volta River, and its 4 main sub-catchments: the Black Volta, the White Volta, the Oti River and the Lower Volta, flow primarily through Burkina Faso

and Ghana. The River has an average mouth discharge of 1,210m^3/s into the Gulf of Guinea and an average annual discharge estimate at about 38km^3.

Table 1. Area distribution of the Volta Basin

Country	**Area of Basin (km^2)**	**% of Basin Area**	**% of Country Area**
Benin	13,590	3.41	12.1
Burkina Faso	171,105	42.95	62.4
Côte d'Ivoire	9,890	2.48	3.07
Ghana	165,830	41.63	70.1
Mali	12,430	3.12	1.0
Togo	25,545	6.41	45.0
Total	**398,390**	**100**	

(VBA, 2009)

With greater distance from the coast, aridity increases, the growing season becomes shorter and rainfalls are more erratic. Annual precipitation rates vary from 1,100mm/year to 500 mm/year in the southern and northern part of the basin, respectively. With climatic conditions reaching as high as 44^oC[12], the potential evaporation rates are high, ranging from 1,500mm/year in the south to more than 2,500mm/year in the north. This means that less than 10% of the precipitation contributes to the river flow.

Socio-economics and water use

The countries of the Volta River Basin are some of the poorest in the world having underdeveloped economies, with the majority of people living under the poverty line. The Volta Basin is home to a little over 23 million people, of which more than 70% reside in rural areas (see Table 2), who depend on the basin's resources to sustain a livelihood. Water resources essentially play a major role in the promotion of economic growth and reduction of poverty in the Volta Basin. With population expected to grow at a rate of about 2.5% to 3% (reaching a projected 34 million people by 2025), a great deal of pressure is being put on the Volta River and its resources as a result of human activities.

Table 2. Population in the Volta Basin

Country	**1990**	**2000**	**2010**	**2020**	**2025**	**Growth Rate (%) (2000)**	**P/km^2 Density (2000)**	**Urban %**	**Rural %**

[12] Annual mean temperatures in the Basin vary from about 27^{o}C to 30^{o}C. Daily temperatures can be as high as 32^{o}C to 44^{o}C, whereas night temperatures can be as low as 15^{o}C.

Benin	382,328	476,775	596,000	746,000	82,000	2.27	43.4	36	64
Burkina Faso	7,014,156	8,874,148	11,227,366	14,204,605	15,997,351	2.38	41.53	22.6	77.4
Côte d'Ivoire	-	397,853	497,469	632,313	717,672	2.53	8-22	23	77
Ghana	5,198,000	6,674,376	8,570,068	11,004,000	11,696,054	2.5	26-105	16	84
Mali	380,000	625,000	880,000	1,140,000	1,260,000	2.78	45-75	12.2	87.8
Togo	1,189,900	1,594,446	2,153,719	2,891,457	3,385,266	2.80	66	30	70
Total	**14,474,276**	**18,642,598**	**23,924,622**	**30,618,560**	**33,876,343**				
Average						**2.54**	**48.49**	**23.30**	**76.70**

(Andah et al. 2005)

Rain-fed, and to a lesser extent irrigated agriculture are the main livelihood activities that most people within the basin are engaged in, generating about 40% of the basin's economic output. It goes without saying, rain-fed agriculture is highly vulnerable because of its dependence on the spatial and temporal variability of rainfall and climate change. As such, the climatic conditions are likely to push people towards irrigated agriculture to meet certain targets, e.g. food production, further contributing to an increased need for water.

There is also an increasing demand for water in industries to promote economic growth and municipalities. Ghana, for example, uses water to generate hydropower which is used to supports major industries (e.g. mining, aluminium, etc.). With industrial and municipal water demands, supplies are being additionally stretched (among other concerns that are likely to increase, e.g. pollution problems, environmental degradation).

Table 3. Synthesis of water abstraction from surface and ground waters by types of usage

Drainage basin	**Urban drinking water supply (**$10^6 m^3$**)**	**Rural/semi-rural drinking water supply (**$10^6 m^3$**)**	**Irrigation (**$10^6 m^3$**)**	**Livestock farming (**$10^6 m^3$**)**	**Other: mines, industry, etc. (**$10^6 m^3$**)**	**Total (**$10^6 m^3$**)**
Black Volta						
Surface water	0.01	0	*a*	*a, b*	*a, b*	*a, b*
Ground water	12.83	19.2	*a*	*a, b*	*a, b*	*a, b*
Total	12.84	19.2	289	*b*	*b, c*	*b*

White Volta						
Surface water	51	0	*a*	*a, b*	*a, b*	*a, b*
Ground water	4.15	26.7	*a*	*a, b*	*a, b*	*a, b*
Total	55.15	26.7	245	*b*	*b, c*	*b*
Oti						
Surface water	0.58	0	*a*	*a, b*	*a, b*	*a, b*
Ground water	0.97	11.7	*a*	*a, b*	*a, b*	*a, b*
Total	1.55	11.7	56	*b*	*b, c*	*b*
Lower Volta						
Surface water	74.3	0	*a*	*a, b*	*a, b*	*a, b*
Ground water	0.06	15.2	*a*	*a, b*	*a, b*	*a, b*
Total	74.36	15.2	70	*b*	*b, c*	*b*
Basin Total						
Surface water	125.89	0	*a*	*a, b*	*a, b*	*a, b*
Ground water	18.01	72.8	*a*	*a, b*	*a, b*	*a, b*
Total ($10^6 m^3$)	143.9	72.8	660	51	*b, c*	927.7
Total (%)	15.5	7.8	71.1	5.5	*a, b*	100

a division between surface water/groundwater not established (data lacking or unreliable)
b estimate not established (data lacking or unreliable)
c withdrawals for marginal types of use as compared to others –negligible impact (<1%) of total volume withdrawn

(VBA, 2011)

Main industries in the basin

The basin includes primarily urban areas of Ghana and Burkina Faso in which there is water demand for domestic consumption. Total domestic water use will increase to 1058 x $106m^3$ by 2025, a projected 35% increase since 2000 where water consumption was estimated at 360 x $106m^3$.

Water use for agricultural production is the highest. Irrigation water use is anticipated to increase in the basin to about 82% in 2020. With concerns over water availability in the coming years with climate change looming, this increase in water demand is expected to be greater.

In Ghana, water is most often seen as a source of hydropower while in Burkina Faso, the development of water resources in rural areas for household use, livestock and irrigation is most important. Akosombo Dam was constructed to supply electric power from the Volta River for industry and for lighting towns and villages in Ghana and neighbour countries. The Akosombo and Kpong dams are still Ghana's major source of electricity. Demand for power continues to increase in the country especially within the urban-industrial sector. The ongoing construction of the Bui Dam in the Bui Gorge (Black Volta) is to fill the gap and increase Ghana's generating capacity. This indicates the country's continued commitment to hydropower as an engine of growth.

Industrial activities are centred near or within the larger capital cities or along the coast. Given that there is only one capital city in the basin (Ouagadougou, Burkina Faso) and there is only a short coast line, industrial activity is relatively low. Most industries are located in the major population centres such as Ouagadougou and Bobo Dioulasso in Burkina Faso, and Tamale in Ghana. There are no significant water withdrawals by industries in the basin. Polluting discharges may, however, occur. Although the industrial sector is not well developed in Burkina Faso, it constitutes a principal source of pollution.

Mining (primarily in gold and copper) remains small and mostly artisanal.

Hydrology, floods and droughts

The Volta River is divided into 4 main river systems, the Black Volta, the White Volta, the Oti River and the Lower Volta system. Water from the Black Volta, the White Volta, the Oti River tributaries flow into the Volta Lake (a by-product of the Akosombo Dam constructed in 1964 and the largest reservoir in the world) which eventually flows out into the Lower Volta and discharges into the Gulf of Guinea. The total length of the main river (the Volta River) is 1,600km.

Rainfall is the primary source of water in the basin. Some of the rainfall is evaporated from various surfaces (e.g. the total annual evaporation from the Volta Lake is estimated to be $10.2km^3$ which is which is largely compensated by $7.9km^3$ of rain falling directly on the lake giving net losses of 7.5% of total flow), some is transpired by natural vegetation and crops, some percolates through the soil to recharge aquifers and the rest appears as runoff (the total annual runoff is on average about $40km^3$) which varies considerably between wet and dry seasons and from year to year.

The Black Volta has the lowest average runoff coefficient (RC = 4.9%) followed by the White Volta (RC = 7.1%), then the Oti River (RC = 13.5%). The topology around the Oti River is characterised by steep terrain which explains the higher runoff coefficient, where as the Black Volta and the White Volta drain relatively flat areas.

Flooding as a result of changes in water quantity and seasonality of flows occurred in the Volta Basin, particularly within the Lower Volta River area, however this helped prevent the development of sandbars which enabled upstream flow of sea water reducing the number of aquatic weeds and the amount of water-related diseases, in particular schistosomiasis, from developing.

Seasonal flooding has been affected by the construction of the Akosombo Dam impacting the environment. Furthermore, the creation of uncoordinated dams without appropriate management practices, make the occurrence of flooding more irregular. Flooding has a trans-boundary cause in the basin as it results from extremes rainfall events and uncontrolled dam releases from the upper part of the basin, e.g. from Burkina Faso to Ghana on the White Volta, from Burkina Faso to Togo water from the Kompienga Dam, and also from Burkina Faso to Mali on the Sourou River as the backwater effect from the management of the Léry Dam.

Changing seasons also affect floods. A longer dry season, followed by more intense rainfall, leads to a higher likelihood of floods. This is the case mainly for the Oti, the Pendjari, the White Volta and the Black Volta.

Land-use conversions also exacerbate the problem. Soils with significantly reduced vegetation cover that are exposed to atmospheric elements have little infiltration capacities to reduce storm water run-off. Another emerging problem is that some river channels are illegally diverted for the purpose of mining. These newly created river channels are often shallow so in the event of storm water run-off, the carrying capacity of these new channels are not able to carry the amount of water causing serious flooding in the area and affecting the environment.

Drought is a common occurrence, typically in the upper and mid part of the basin where climatic conditions are harsher than in the south.

In the 1970s and 80s the region experienced several periods of drought characterised by an overall decrease in the number of rain. With changes in the climatic conditions, the likelihood of floods and droughts are likely to be impacted.

Hydraulic infrastructure

Throughout the Volta Basin, dams and reservoirs have been created in order to mobilise water for agricultural and industrial use, and for energy production. The number of large and small dams continues to increase as population pressure grows. Increasing use of water and decreasing precipitation due to climate change in the region, threatens the management of the water and its benefits[13].

The Akosombo Dam in Ghana is the most significant hydraulic infrastructure in the Volta Basin, which holds back water flowing from the Black Volta, the White Volta and the Oti River. The dam is used for hydro-power generation, contributing to about 80% of the power produced in Ghana. Irrigation and other consumptive uses in the mid and upper reaches of the basin compete with the generation of hydro-power. With changes in the climatic condition, the increase in turning to irrigated agriculture will require the development of a trans-boundary water management approach to manage water use to meet the needs of all users.

Other major hydraulic infrastructure important for either irrigation or hydro-power generation (or both) are in Ghana (the Kpong Dam) and Burina Faso (the Léry Dam, the Ziga Dam, the Kompienga Dam and the Bagré Dam), while the remaining 4 countries have small-scale hydro-power dams, storage facilities and irrigation schemes.

Institutional environment

The Volta Basin faces many development challenges to meet the needs of an increasing population, challenges that require a basin-wide response. Although the countries within the basin are pushing to adopt IWRM schems, the institutional environment is characterised by uncoordinated policies and development initiatives which are a threat to the sustainable management of the basin. There are no formal legal and institutional arrangements to manage disputes across borders over resources or coordinated trans-boundary schemes for the sustainable management of the basin and its resources.

[13] e.g. The Akosombo Dam is used at unsustainable rates, the pressure to produce more energy is so high that the Volta River Authority (the energy producing institution) lets too much water through the dam in the hope that next year's rains will replenish the reservoir.

Key issues
In addition to the imbalance between water demand and supply potential, the key issues in the basin relates to,

- climate change,
- decrease in water availability,
- irregular flooding, drought,
- reduced hydropower generation,
- ecosystem (basin) degradation,
- poor management of water infrastructure,
- poor socio-economic infrastructure,
- trans-boundary tension,
- limited human and institutional capacities,
- widespread poverty,
- growing population, and
- spread of water-related diseases.

Projects and programs
Several water infrastructure projects, in particular the construction of hydro-power dams, for power generation, water storage and irrigation schemes.

Other projects are geared towards more adaptive approaches to the changing situation. For example the GLOWA Volta Project (GVP)[14] or ADAPT[15].

Projects and programs promoting trans-boundary management of the basin to improve water governance and water management practices, e.g. the Strategic Action Programme (SAP)[16] and the GEF Volta project.

Urban environments and utilities

Overview of urban areas in the basin
About 30% of the roughly 23 million people live within urban areas in the Volta Basin. With continued urbanization, growth in urban areas will be even greater than in rural areas, leading to high concentrations of demand for water and natural resources. The urban areas is within the basin are often characterised as engaging in the service sector (employing 6-30% of the labour force), followed by industry then urban agriculture.

The major population areas in the basin include Ouagadougou (of Burkina Faso), Tamale and Bolgatanga (of Ghana) in the White Volta sub-basin and Bobo Dioulasso (of Burkina Faso) in the Black Volta sub-basin. Others are the Kara region of Togo in the Oti basin and in the lower reaches of the Volta Lake and Lower Volta River in southern Ghana (see Table 3).

[14] The GLOWA Volta Project (GVP) is geared towards the analysis of the physical and socio-economic determinants of the hydrological cycle in the Volta Basin in the face of global change (currently in phase 3, which is aimed towards the synthesis of the research, capacity building, and the transfer of decision support tools, and knowledge).
[15] The project assess the impacts of climate change and climate variability on global food production and security, environment and livelihoods, link these impacts to similar effects on a basin level and finally develop and promote adaptation strategies for food and environment to alleviate the negative impacts, on a basin scale.
[16] Led to a realization among the six riparian countries of the Volta Basin of the need for a closer and more coordinated approach to managing the basin resources.

Table 4. Major city populations in the Volta Basin

Country	City	Calculated population (2013)
Burkina Faso	Ouagadougou	1,708,079
	Bobo-Dioulasso	555,121
	Ouahigouya	89,148
	Tenkodogo	49,710
	Leo	33,714
	Pô	30, 057
Ghana	Tamale	562,919
	Wa	105,821
	Bolgatanga	68,183
Togo	Kara	103,075

(World Gazetteer online, 2013)

Major Utilities in the Basin

The most significant water consuming towns of the basin are Ouagadougou and Bobo-Dioulasso in Burkina Faso, Bolgatanga and Tamalé in Ghana, Natitingou and Tanguiéta in Benin and Kara and Dapaong in Togo (see Table 4 showing the domestic/industrial water demand of the 6 countries in the basin, these are projected to increase due to rapid population growth, industrial expansion and climate change). Their safe water supply is generally secured from a combination of surface and underground water resources.

Table 5. Domestic/Industrial water demand of the Volta Basin (x $10^6 m^3$)

Country	1990	2000	2010	2020	2025
Benin		56	196	336	448
Burkina Faso	67	85	106	132	149
Côte d'Ivoire	-	4	5	12	14
Ghana	82	138	192	272	284
Mali	5	9	13	16	18
Togo	51	68	92	123	145

(UNEP-GEF Volta Project, 2012)

In 1997, the Public Utilities Regulatory Commission was launched to regulate[17] and oversee the provision of utilities in the Volta Basin.

[17] Regulate the supply, transmission and distribution of (treated) water.

- *Benin*: the National Water Society of Benin (SONEB) has been assigned to assure urban water supply and waste water treatment on behalf of local authorities. SONEB is placed under the Ministry of Energy and Water.
- *Burkina Faso*: the national utility National Office for Water & Sanitation (ONEA) manages the urban water and sanitation services. According to the World Bank and USAID, ONEA has an excellent record of performance in West Africa.
- *Ghana*: the Ghana Water Company Limited was set up a year later to provide water supply to urban areas[18]. The Electricity Company of Ghana manages the supply of electricity generated from hydropower plants.
- *Togo*: Togolese Electric Energy Company (CEET) manages the collection, treatment and supply of water and electrical power distribution. Togo Water and the Togolese Electric Energy Company (CEET) hold monopolies in their sectors.

The West African Power Pool (WAPP) is a cooperation of the national electricity companies in Western Africa under the support of the Economic Community of West African States (ECOWAS). The members of WAPP are working for establishing a reliable power grid for the region and a common market for electricity. It was founded in 2000. The following are the power utilities that are part of WAPP,

- *Benin*: While Benin Society for Electrical Energy (SBEE) controls the vast majority of generating capacity in Benin, Electricity Community of Benin (CEB) is an international organisation co-owned by the governments of Benin and Togo. It is in charge of developing electricity infrastructure in both countries which are strongly dependent on energy imports from Ghana.
- *Burkina Faso*: National Electricity Company of Burkina Faso (SONABEL) is the national electricity company of Burkina Faso.
- *Ghana*: Volta River Authority (VRA)[19] and Electricity Company of Ghana
- *Togo*: Electricity Community of Benin (CEB)

Water Safety Plan Implementation Status

Water quality degradation is an important issue in the Volta Basin. Waste, as a byproduct of agricultural, household and industrial activities find their way into the water system of the basin, thereby degrading the quality of water. This is the case because there are inadequate standards for controlling water quality, in particular at the basin level.

In Ghana, the Water Resources Commission was set up to oversee the sustainable utilization of the country's water resources and is responsible for water abstraction, pollution control, water quality standards, water rights, and license fees.

Management of floods and droughts in urban areas

In 2010, the Parliamentary Select Committee on Employment, Social Welfare and State Enterprises (in Ghana) called for establishment of a joint Upper Volta Basin Management Agency (UVBMA) between

[18] The same year, the Community Water and Sanitation Agency was established to administer rural water supplies.

[19] The VRA is the main generator and supplier of electricity in Ghana. In 2005, following the promulgation of a major amendment to the VRA Act in the context of the Ghana Government Power Sector Reforms, the VRA's mandate was largely restricted to generation of electricity. The transmission function has been hived off into a separate entity, designated Ghana Grid Company Ltd. (GRIDCo) to perform the transmission activities. The amendment is expected to attract independent power producers onto the Ghana energy market. VRA's distribution agency has been operationalised into a subsidiary company, the Northern Electricity Distribution Company (NEDCo).

Ghana and Burkina Faso. The UVBMA would be mandated to set up action plans by the appropriate governmental agencies within each country to control the perennial floods in the northern parts of Ghana due mainly to excess water spilled from the Bagré Dam as well as free flow of water from rivers that have their source in Bukina Faso.

Burkina Faso have in place a drainage network to manage potential flooding, however channels are often blocked as a result of waste from urban.

Real time measurement system for operational watershed management (e.g. flood management) has been proposed for the Volta Basin, such a system was to be a continuation after the end of the GLOWA Volta project and complement the Volta-HYCOS project run by the world meterological organization (WMO). Through the Hydro Agros Hydrological Monitoring System (to be managed by the Hydrological Service Department (HSD) Ghana) can provide real time hydrological data that can be used as input data of the Volta Basin Water Allocation System (VB-WAS) in events of extreme floods.

Issue remains that there is insufficient communication between countries on, for example water levels of the Bagré dam and information about possible risks connected to spilling at the high peak of the rainy season. The lack of data and the absence of efficient monitoring networks between the countries (horizontal communication) but also between the centers and the peripheral areas (vertical communication) constitute the main gaps for successful and short term information sharing.

Interaction between Water utilities and Basin Organization

The West African Power Pool (WAPP), founded in 2000, is a cooperation of the national electricity companies in Western Africa under the support of the Economic Community of West African States (ECOWAS). The members of WAPP are working for establishing a reliable power grid for the region and a common market for electricity.

The Volta River Authority in Ghana was established for the sustainable management of natural resources within the basin though the development of joint projects and works among countries in the basin. Within the organization, the Technical Committee of the Volta Basin (CTBV) was established with the purpose of managing the water resources on a regional level according to the IWRM principles and a straightforward vision on co-operation among the member countries and related organisation and water utilities.

Besides this, there is not much information on interaction between water utilities and basin organization, especially at the regional level. Furthermore, there is limited communication between country organizations and utilities at the regional level.

Data and information availability

The Volta-HYCOS aims to develop necessary regional framework, and underlying technical infrastructure of data collection and management, for exchange of information on the status of water resources, which is necessary for development. To ensure that the project is demand driven and to obtain commitments from countries, WMO in collaboration with IRD organized a preparatory meeting in Ouagadougou in March 2004 to present and discuss the draft project document among country representatives. The meeting reviewed the project proposal and made recommendations on the implementation.

GLOWA Volta's Geoportal represents the web-based interface to the Databases: data encompass not only structured (tabular) data, but also documents, graphs, maps and software-modules.

The UNEP/GEF Volta River Basin Project provides information that addressed regional trans-boundary issues and problems as identified through a preliminary Transboundary Diagnostic Analysis (TDA). The

project intends to promote a more sectorally-coordinated management approach, based on Integrated Water Resource Management (IWRM) principles, both at the national and the regional levels, with a strong emphasis on an expanded role for all stakeholders.

GEF past and present involvement in basin

The UNEP/GEF Volta River Basin Project for "Addressing Trans-boundary Concerns in the Volta River Basin and its Downstream Coastal Area" is a regional initiative designed to facilitate the integrated management, sustainable development and protection of natural resources of the Volta River Basin within the six countries of Benin, Burkina Faso, Côte d'Ivoire, Ghana, Mali and Togo.

The long-term goal is to enhance the ability of the countries to plan and manage the Volta catchment areas within their territories and aquatic resources and ecosystems on a sustainable basis. The Project has three main components with associated objectives identified by the root cause analysis carried out during the project preparation process: (i): Build capacity and create a regional institutional framework for the effective management of the Volta Basin; (ii): Develop regional policy, legal and regulatory frameworks for addressing transboundary concerns in the Volta Basin and its downstream coastal areas; and (iii): Initiate national and regional measures to combat transboundary environmental degradation in the Volta Basin.

As the project is demonstrating integrated land and water management the methodology for incorporating floods and droughts into planning is an important component that will enhance the management process.

The leading implementing agencies was United Nations Environment Programme (UNEP) (+25420624165) and the executive agencies were as follows,

- United Nations Office for Project Services (UNOPS) (+12124571874)
- Mali: Direction Nationale de l' Hydraulique (cdidnh@afribone.net.ml)
- Burkina Faso: Direction Nationale de l' Hydraulique (dirh@cenatrin.bf; +226307786)
- Benin: Direction de l' Amenagement du Territoire
- Côte d'Ivoire: Direction de l' Environment
- Togo: Direction de l' Ecologie Generale et de la Rehabilitation du Milieu
- Ghana: Ministry of Environment, Science and Technology (MEST) (+23321666049)

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Key websites
GLOWA Volta - http://www.glowa-volta.de/
GEF Volta - http://gefvolta.iwlearn.org/
Volta Basin Authority - http://www.abv-volta.org:10000/abv2/

LEARNING BASINS

Danube River Basin - Overall features

Physical characteristics and climate

The Danube River Basin (DRB) is the longest (2,780 km) and the second largest (801,463 km^2) river basin in Europe comprising 10% of the continent. It is the most shared international river basin in the world between 18 countries: Germany, Austria, Czech Republic, Slovakia, Hungary, Slovenia, Croatia, Bosnia-Herzegovina, Serbia-Montenegro, Romania, Bulgaria, Moldova, Ukraine as well as Switzerland, Italy, Poland, Albania and Macedonia. There are many tributaries that drain into the Danube including the Inn, Morava, Drau, Tisza, Sava, Iksar, Siret and Prut. There are 26 major tributaries of the Danube River, all of which have their own sub-basins. The Tisza River Basin is the largest sub-basin in the Danube (157,186 km^2) and is the longest tributary (966 km). The Sava River is the largest Danube tributary by discharge (average 1,564 m^3/s) and the second largest by catchment area (95,419 km^2).

The geography and climate of the Danube river basin is very diverse. The basin has high mountain chains, large plains, sand dunes, large forested or marshy wetlands and, very specifically the karst and the delta. Precipitation ranges from 1,000 - 3,200 mm per year in the mountainous areas to 350-600 mm per year in the lowlands and delta. In addition, the Danube River and its basin is an area of high biological diversity.

Map of the Danube Basin

Socio-economics

The present population in the Danube river basin is about 83 million people with a population density of 102 people per km^2. There is a wide gulf between the GDP per capita of Austria, Germany and Slovenia and the other Danube Basin countries: the wealthiest country's GDP per capita is nearly 14 times higher than that of the poorest. Large cities such as like Vienna, Belgrade, Budapest and Bucharest are located in the basin. Economically, the Danube River basin is one of the most important rivers in Europe, providing a resource for different water uses including drinking water supply, industry and energy production,

transport, irrigation in agricultural areas, waste water recipient, etc. However, many of the economic activities in the Danube region are having a negative impact on the environment. The key factors influencing the overall environmental quality and in particular water quality are industrial activities, agriculture and municipalities.

Industry and mining represents a major economic sector throughout the region and its participation in GDP varies from 31% (Slovakia) to 42 % (Romania). The total volume of abstracted water from the Danube river system is currently 12.7 billion m^3/ year of which 62% is abstracted for industrial and mining purposes; for cooling purposes an additional 15.4 billion m3/year are abstracted. In the downstream countries the main user is agriculture, which accounts for 85 % of total use in Moldova. In upstream countries, such as Slovakia, the main water user is industry (accounting for up to 71 % of total surface water withdrawals).

Hydrology, floods and droughts

The hydrological regime, especially the runoff conditions of the Danube, is substantially influenced by precipitation with an average discharge of 6550 m3/sec at its mouth in the Danube delta.The Danube Delta is largely situated in Romania and partly in Ukraine. The protected area covers 679 000 ha including floodplains and marine areas, and 547,000 ha were established as a "World Nature Heritage" in 1991. The Delta is an environmental buffer between the Danube River and the Black Sea, filtering out pollutants and enabling both water quality conditions and natural habitats for fish in the Delta and in the environmentally vulnerable shallow waters of the north-western Black Sea.

The upstream portion of the Danube river has a high-water season and low-water season, whereas further downstream the discharge regime downstream from larger tributaries tends to have two peak discharges each year. There is a lot of attention on flooding in these downstream lowland areas of the Danube, however, upstream flash floods and torrential floods of small streams have even higher damage potential. Recent results in hydrological and climate modelling, indicate an increasing probability of extreme drought events during summers and extreme rain events during winters.

Hydraulic infrastructure

There are numerous different engineering works for navigation, hydropower, flood control, agriculture and water supply. Approximately 56% of the river basin has been classified as highly modified. For example, Europe's largest flood defense network was created along the Tisza tributary, with regulation of rivers, construction of flood embankments and flood walls, system of drainage canals, pumping stations and designated flood retention reservoirs (polders) completing the system.

Institutional environment

The Danube River Protection Convention signed in 1994 and in force since 1998 is the overall legal instrument for co-operation on transboundary water management in the Danube River Basin. It aims to ensure that surface waters and groundwater within the Danube River Basin are managed and used sustainably and equitably. The International Commission for the Protection of the Danube River (ICPDR) is a transnational body with 13 cooperating states and the European Union. ICPDR has been established to implement the Danube River Protection Convention, and is the platform for the implementation of all transboundary aspects of the EU Water Framework Directive (WFD). The WFD commits European Union member states to achieve good qualitative and quantitative status of all water bodies by 2015. The framework provides guidance on reaching this goal.

Key issues
Drastic changes to the Danube's natural flow and surrounding lands to control floods, generate power, facilitate agriculture and waterway transport have already destroyed over 80% of the watershed's valuable wetlands, floodplains and forests. This includes significantly impacting the quality of drinking water on which tens of millions of people depend.

Municipal, industrial and agro-industrial pollution have significantly affected the water quality in the Danube River Basin. The major polluting industries are: ore mining activities; chemical and petrochemical industries; pulp and paper; metal works and machinery; food industry and textile industry. The generated domestic and industrial wastewater, which is collected by public sewer systems from the towns and urban settlements and discharged into the river basin, contributes to the nutrient load and microbiological pollution. Non-point sources across all countries in the Danube basin are due to the inappropriate use of fertilizers and pesticides. This causes an alteration in the nitrogen balance and an increase of pesticides in soil and water.

While floods are naturally occurring events in the basin, human impacts have increased the risk of flooding through inappropriate land-use in high-risk areas and by interfering with natural processes. For example, urbanization increases the frequency of high flows and reduces the time to reach peak discharges because of soil sealing and increased run-off.

Projects and programs
There are numerous projects and programmes in the Danube River Basin. For example, the ICPDR acts as a platform for its contracting parties to coordinate responses to various environmental threats, formalised in the Danube Protection Convention of 1994. The Danube River Management Plan (DRBM) provides a roadmap, which includes a Joint Programme of Measures and aims to fulfill the EU Water Framework Directive (WFD).

Urban environments and utilities
Overview of urban areas in the basin
The majority of the population (> 50%) in the basin lives in urban areas in all the countries, except Slovakia (48% urban population).

One of the main issues relating to urban areas is that municipalities generate around 60% of the wastewater discharged into the Danube River Basin, and much of this wastewater is released into rivers not sufficiently treated. Inadequate management and treatment of municipal wastewater has been identified as one of the core problems in the Danube River Basin.

Major Utilities in the Basin
There are many water service companies serving cities and towns in the basin. This summary concentrates on the largest urban areas impacted by water shocks including Vienna, Belgrade, Bucharest and Budapest. The utilities described are the First and Second Vienna Mountain Spring Pipeline (MSP), Budapest Waterworks, PUC "Belgrade Waterworks and Sewerage", and Apa Nova (Bucharest).

In Vienna drinking water protection has been in place for the water sources under the Vienna Water Charter. The water resources for drinking in Vienna city is from two Alpine springs located in the Rax-Schneeberg area and the Hochschwab massif (270 km from the city) providing 400,000 m^3 of water daily to Vienna. About 100,000 building connections are serviced through a supply network of approximately 3,200 km length. Vienna Waterworks operates 32 water reservoirs with a total reserve capacity of 1,650,000 m^3, a volume equal to about three times the daily consumption.

Budapest Waterworks supplies almost 2 million people daily with water for drinking as well as industrial use. In the capital the piped network is almost 5,100 km long. The water cleaning, network operating and water quality monitoring activities are supported by world standard technologies.

Belgrade Waterworks and Sewerage annually produces over 210 million cubic meters of water. Water is treated in 5 five treatment plants with a total capacity of 8 000 liters of water per second, through complex technical and technological systems and has a 3,153 km distribution network supplying more than 2 million people. The Belgrade sewer system collects and removes waste and storm waters. The company maintains the sewer network, monitors, manages and maintains the network of 212 km of collectors, 1,463 km of pipe network, 32,820 gullies and 53,694 sewerage connections. Belgrade Waterworks & Sewerage has an annual water production of 245 million cubic meters serving a population of 1.5 million.

The drinking water supply in Bucharest is provided by the company "Apa Nova", which is the Romanian branch of Veolia Water. Business scope includes water source management, water treatment, supply to consumers, as well as wastewater and storm water discharge. The company supplies more than 1.7 million consumers with water supply and sewerage. The supply network in Bucharest is 2427 km in length and the sewerage network is 2124 km long.

Water Safety Plan Implementation Status

Vienna Spring Water Supply is working to create a Water Safety Plan (WSP) and implementation is to take place in 2013. The WSP approach ideally requires extensive scientific and technical input from a multidisciplinary team of experts. However, in small and medium sized municipalities in Austria, financial and personnel resources are limited. A modified tool has been developed which provides an overview of the required steps, explains how to carry out each step and guides the user through the three key components: system and hazards assessment, control measures and operational monitoring, and management.

Water safety planning in Hungary has been integrated into public policy through amendment of Hungarian legislation in 2009. When a utility is providing drinking water at a capacity of more than $1000m^3$/day or for more than 5000 people, a water safety management system needs to be defined in the WSP. When water is being supplied to more than 100,000 people, then the WSP must be submitted for approval to the National Office of the Chief Medical Officer.

In Romania only 76% of rural areas have access to improved water supply and 7 million people get their drinking water from the sources that are not well protected. As local awareness of water safety issues is very low, there is a high risk of water pollution in the country. Water safety issues are still not recognized in Romania, even though the government has committed to the EU WFD. There is no legal obligation in Romania that forces utilities to undertake development and implementation of WSPs. Therefore, Apanova Bucharest does not currently have a WSP prepared and approved.

Belgrade Waterworks and Sewerage does not have a formalized WSP, although parts of the requirements exist. For example, water quality control follows national regulations for hygienic drinking water (Official Gazette 42/98). The regulations comply with EU Directives and recommendations from the World Health Organization. Studies show that Belgrade Waterworks and Sewerage is the only water utility in Serbia where over 95% of samples of the drinking water meet the requirements of the WHO.

Management of floods and droughts in urban areas
Many large floods have occurred in the DRB, causing numerous human casualties and material damage. While floods are naturally occurring events of the water cycle, human impacts increase the risk of flooding through inappropriate land-use in high-risk areas and by interfering with natural processes. Climatic variations are expected to further increase the risk of flood related damages. As a response, in 2004, the International Commission for the Protection of the Danube River (ICPDR) adopted the long-term Action Programme for Sustainable Flood Prevention in the Danube River Basin. The overall goal of the Action Programme is to achieve a long term and sustainable approach for managing the risks of floods to protect human life and property, while encouraging conservation and improvement of water related ecosystems. The programme deviates from the common practice of mainly taking defensive action against water-related hazards and recognizes floods as a natural part of the hydrologic cycle. It emphasizes the need to learn how to live with floods and manage risk through a basin approach, with governments, municipalities and stakeholder participation.

Large parts of Europe have been also affected by drought over the past 50 years including areas within the Danube Basin. Although events differ in character and severity, the frequency of occurrence showed that drought is a normal recurrent feature of the European climate. In response, the Joint Research Centre of the European Commission is developing a set of drought indicators, incorporating the impact of water stress on the natural vegetation and on agriculture. The Research Centre is carrying out a feasibility study on drought modelling for Europe, using a test region within the Danube catchment area as an example.

Water companies and authorities are facing new challenges with more frequent, higher impact cycles of flood and drought. Although there is limited specific measures in place for flood and drought management within utilities, changes in water availability has led to adaptation measures in designing and operating sewerage systems for situations with heavy rain and providing drinking water in dry summers.

Interaction between utilities and basin organizations
The interaction between utilities and basin organizations varies between countries depending on the national frameworks. For example in Romania all water companies have direct links with all river basin agencies (11 in Romania), both in terms of raw water extraction and discharge of treated wastewater. They are also part of the River Basin Committees where they are developing medium and long term water resources planning and are establishing action plans to comply with EU requirements. The 11 basin management plans in Romania were assembled in the Danube River Basin Management Plan which was developed by the ICPDR in 2009.

The ICDPR coordinates technology exchange in areas such as the construction or modernization of wastewater treatment plants. ICDPR is also involved in the implementation of the EU Water Framework Directive, and the EU Flood Directive as well as the orchestration of basin-wide flood protection measures; implementation of the EU Water Framework Directive. In regards to utility interaction with ICDPR on these directives; coordination appears to be at the national level.

Data and information availability
Inventories and databases are fundamental requisites to assess the human influences to the environment. A multitude of input parameters are collected by the Danube countries and shared in the ICPDR operated database. This includes also specific investigations based on international reporting requirements covering a diversity of pressures (for pollution form the municipal, industrial, and agro-industrial sector). The purpose of the ICPDR database is:

- The national authorities can share and exchange information and good practices;
- The scientific community can use the information for research projects to improve approaches and methodologies;
- The interested public is able to access data to learn more about the environmental aspects of the Danube.

The databases comprise:

- Water Quality Database (Trans National Monitoring Network). TNMN water quality data from 1996 and onwards
- Danube Surveys Database. Joint Danube Survey, Investigation of the Tisza River
- Bucharest Declaration Database
- Water Quality 1992-1998
- Projects Database, prioritization of Water Sector Investment Projects in the Danube River Basin

GEF past and present involvement in basin

The Danube Basin, shared by 19 countries, is viewed as a global model for the success of integrated water resource management (IWRM) in sustaining the environmental damage prior to the 1980s, including the loss of 80% of its wetlands and floodplains. According to German Environment Minister, Sigmar Gabriel, support from GEF was rather significant in helping strengthen both the environment and the political stability of the entire Danube Basin. Over a period of 15 years (1991-2007), the support provided by the GEF/UNDP helped prepare countries for the challenge of building a successful IWRM framework for the basin.

During the 15 years, GEF and its partnering organization have provided countries with significant assistance in improving their capacity to continue meeting the EU's legislative challenges. In 1992 a joint partnership between the European Commission (EC) and UNDP/GEF were tasked with the management of the Environmental Programme for the Protection of the Danube River basin established in the previous year. A year later (1993) the Bucharest Convention on Protection of the Black Sea led to the 1st UNDP/GEF project on a trans-boundary diagnostic analysis to inform a rehabilitation and protection programme for the Black Sea. This was followed by the International Commission for the Protection of the Danube River (ICPDR) established in 1998 as the main implementing body of the Convention. By 2001, a Strategic Partnership was established, bringing together the key stakeholders in a 'basin-wide approach' with three components: (1) the UNDP/GEF Danube Regional Project[20]; (2) the UNDP/GEF Black Sea Ecosystem Recovery Project[21]; and (3) the World Bank/GEF Investment Fund for Nutrient Reduction[22].

From 2001 to 2007 GEF-funded Danube Regional Project's main goal was to strengthen the capacity of the ICPDR and Danube countries to cooperate in fulfilling their commitments to implement the Danube Convention and EU Water Framework Directive (WFD).

[20] Was implemented by UNDP and involved the International Commission for the Protection of the Danube River.
[21] Was developed under the GEF and involved UNDP, the UN Environment Programme and the UN Office for Project Services.
[22] Was an investment fund created by the World Bank to provide GEF grant support to leverage World Bank financing for nutrient reduction investments.

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Useful websites

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Appendix 16: Response to Reviews

Response to Reviews

The comments received from STAP, Germany and France, were fully taken into consideration when preparing this Project Document and finalizing the design of the project. Comments revolved essentially around the following specific themes:

1) *Better take into consideration local needs, and capacities (France, STAP);*
2) *Give a clear, effective description of what the project intends to do, and where (Germany);*
3) *Make a convincing case for the proposed project, including endorsements from beneficiaries (STAP).*

1. *Better take into consideration local needs, and capacities*

The various tools aimed at incorporating consideration of the increased climatic variability and of the decreased ability to predict extreme climatic events, in particular floods and droughts, as part of basin planning processes *will be developed in a participatory process involving key stakeholders from selected basins* (see especially activities 1.1.1.2). The stakeholder involvement will ensure that the enhanced tools and recommended methodologies are responding to user needs and capacities, and can be used to address key water resources management issues in the particular basin. In order to operate within the limits of the resource allocation and at the same time work with an in-depth, sound science and on-the-ground approach and process, it has been necessary to limit the number of basins to three, which then will act as pilot basins. The tools and recommended methodologies will thus be developed and tested in these basins, where recommendations for planning processes (including the TDA/SAP) will be drawn (component 2 and all activities within). Guidelines will be developed based on the experience achieved and such generic guidelines will allow other transboundary basins to undertake similar processes and work with the same, but context-adjusted tools (see Components 1 and 2 of the project).

2. *Give a clear, effective description of what the project intends to do, and where.*

Appendix 4 of the project document (the project's Strategic Results Framework), provides a comprehensive synopsis of the outcomes expected to be achieved with the project, and of the relative indicators and targets. Section 3.2 of the project document provides a description of the outputs of the project, and of the activities needed to produce these outputs.
Once the DSS tools are developed, they will be tested on the ground at three sites: the Volta, the Lake Victoria and the Chao Phraya basins. Section 3.1.5 of the project document outlines the screening process and rationale for the selection of these basins. Appendix 15 of the project document provides additional relevant information about the three basins selected.

3. *Make a convincing case for the proposed project, including endorsements from recipient countries.*

GEF's extensive portfolio of more than 50 IWRM-related projects in 30 lake and river basins throughout the world has highlighted the need to include careful consideration of floods and droughts within the International Waters Focal Area Strategy for GEF-5. Indeed, extreme climate events are a reoccurring theme of many TDAs and SAPs. The goal is to be able to combine, consider and address multiple priority stresses for individual water bodies with a view to optimizing water

resources management. Introducing flood and drought management Decision Support Systems to support decision-making processes can achieve this.

Tools, such as DSSs for hydrological systems and water safety plans, and their application in pilot basins is a significant part of the baseline project. However, these tools have not been designed to address the increased frequency and unpredictability of extreme climatic events, such as floods and droughts. Floods and droughts add to the challenges of water reources management. As the pressures on water resources increase, so does the urgency of applying sustainable management options. Implementing IWRM is a long term process that is extremely challenging on local and national levels. On a transboundary level these complexities are multiplied, as are the risks of failure. *While this project does not seek to directly address all the complexities of addressing climate climate variability and unpredictability impacts in transboundary water management, it does aim to provide the necessary tools for others to do this.*

It is expected that the project, by building the countries capacity to recognize and address the transboundary implications of the increased frequency and unpredictability of floods and droughts, will accrue global environmental benefits by strengthening cooperation among countries sharing the resource, enhance ecosystem sustainability, and foster water security (Section 3.1.4).

Basin organizations and institutions of GEF recipient countries that will be involved in project execution have endorsed this approach, and will contribute with their own resources to the implementation of the project for a total of approximately US dollars 5 million (see letters of endorsement attached to the Project Document in Appendix 12).