ADAPTATION FUND

REGIONAL PROJECT/PROGRAMME PROPOSAL

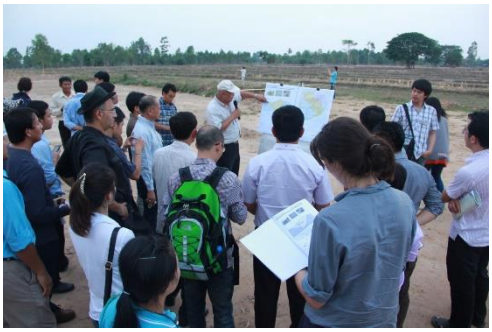
PART I: PROJECT/PROGRAMME INFORMATION (Summary)

Title of Project/Programme:	Groundwater resources in the Greater Mekong Subregion: Collaborative management to increase resilience
Countries:	Cambodia, Lao People's Democratic Republic, Myanmar, Thailand, Vietnam
Thematic Focal Area:	Transboundary water management
Type of Implementing Entity:	MIE
Implementing Entity:	UNESCO
Executing Entities:	National Agencies, CCOP-TS, IWMI, IGRAC
Amount of Financing Requested:	**US $ 4,898,775**

Inside cover (blank)

Groundwater resources in the Greater Mekong Subregion: Collaborative management to increase resilience

A collaboration of Cambodia, Lao People's Democratic Republic, Myanmar, Thailand and Vietnam to increase climate resilience in the Greater Mekong Subregion through improved groundwater management and transboundary cooperation

United Nations Educational, Scientific and Cultural Organization

International Hydrological Programme

COORDINATING COMMITTEE FOR GEOSCIENCE PROGRAMMES IN EAST AND SOUTHEAST ASIA (CCOP)

IWMI International Water Management Institute

IWMI is a member of the CGIAR Consortium and leads the:

CGIAR RESEARCH PROGRAM ON Water, Land and Ecosystems

igrac International Groundwater Resources Assessment Centre

Inside cover

Front cover pictures: courtesy IWMI team Lao PDR

Bangkok, July 2016; revised version Jun 2017

Content page

Annexes

Abbreviations

ADB	Asian Development Bank
AF	Adaptation Fund
ASEAN	Association of Southeast Asian Nations
AVID	Australian Volunteers for International Development
AWP	Annual Work Plan
CCA	Climate Change Adaptation
CBDRM	Community-based Disaster Risk Management
CBNRM	Community-based Natural Resource Management
CBOs	Community Based Organizations
CCOP-TS	Coordinating Committee for Geoscience Programmes in East and Southeast Asia – Technical Secretariat
CoP	Community of Practice
DIWU	Department of Irrigation and Water Utilization (Myanmar)
DMH	Department of Meteorology and Hydrology
DRR	Disaster Risk Reduction
DWRPIS	Division for Water Resources Planning and Investigation in the South of Vietnam
GEF	Global Environment Facility
GGMN	Global Groundwater Monitoring Network
GGIS	Global Groundwater Information System
GMS	Greater Mekong Subregion
GW	Groundwater
GWES	Groundwater for Emergency Situations
IHP	International Hydrological Programme
IMS	Information Management System
INGO	International Non-governmental Organization
IGRAC	International Groundwater Resources Assessment Centre
IWMI	International Water Management Institute
IWRM	Integrated Water Resources Management
MAR	Managed Aquifer Recharge
M&E	Monitoring and Evaluation
MIE	Multilateral Implementing Entity
MONRE	Ministry of Natural Resources and Environment
MRC	Mekong River Commission
MSL	Mean Sea Level
NAWAPI	National Center for Water Resources Planning and Investigation (Vietnam)
QGIS	Quantum GIS – Geographic Information System
SDGs	Sustainable Development Goals
TBA	Transboundary Aquifer
TWAP	Transboundary Water Assessment Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
WASH	Water, Sanitation and Hygiene
WRUD	Water Resources Utilization Department (Myanmar)

Intentionally left blank

Groundwater resources in the Greater Mekong Subregion: Collaborative management to increase resilience

PART I: PROJECT INFORMATION

1. Project Background and Context

Brief information on the problem the proposed project/programme is aiming to solve, including both the regional and the country perspective. Outline the economic social, development and environmental context in which the project would operate in those countries.

1.1 Resource status: Groundwater in the Greater Mekong Subregion

The countries of the Greater Mekong Subregion (GMS – Cambodia, Lao People's Democratic Republic (Lao PDR), Thailand, Myanmar and Vietnam) have abundant surface water resources in the large rivers of the region – the Mekong alone discharges around 475 km³ annually, and the Ayeyarwady around 400 km³. Even though surface water is abundant, a significant contribution to overall water supply comes from groundwater (GW). GW use is common and widespread in the lowlands and plains and is especially used to cover water needs in the prolonged dry season. The GMS countries have a total population of about 240 million people; a considerable number are low-income groups and urban/rural communities that rely on easily accessible, reliable, good quality and low-cost GW for their domestic use and agrarian-based livelihoods. GW use has been increasing as water needs from different sectors are rising and drilling and pumping costs have become more affordable. This trend is likely to continue in view of growing demand for food security and livelihood enhancement, meeting Sustainable Development Goals (SDG's) and adapting to climate change. The long-term impacts from increased groundwater use on domestic and industrial supplies and the resource in general, including the ecosystems served, remain unclear.

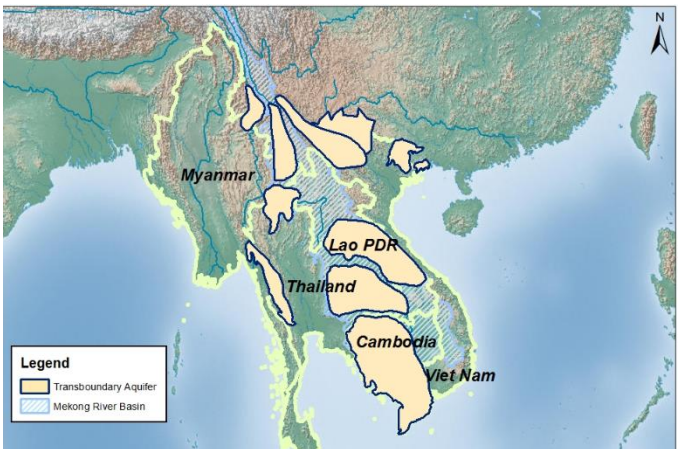


Figure 1: Overview of the main transboundary groundwater aquifers in the Greater Mekong Subregion; source IGRAC.

GW is an important resource in the highlands as well as the lowlands along the Mekong River in Lao PDR, in northeast Thailand, Cambodia, in the Mekong Delta in Vietnam and in Myanmar's Central Plain. Important transboundary aquifers straddle the border areas and highlight the need for bi- or tri-partisan cooperation for effective management of shared resources (Figure 1; see also Landon, 2011 [1]). Throughout the GMS, complex relationships occur between upstream recharge areas and downstream aquifers. The total potential capacity of GW resources is estimated to be about 60 million m³/day. But GW resources of the GMS have not been investigated in detail, and only limited information about resource volumes, use, sustainability and quality is available. Recent studies (i.e. Erban, 2014[2]; Wagner et al., 2012[3]) illustrate the intensive use and economic significance of GW for both the

[1] Landon. M., 2011; Preliminary compilation and review of current information on groundwater monitoring and resources in the Lower Mekong River Basin. USGS report to Mekong River Commission.
[2] Erban, L. S.M. Gorelick & H.A. Zebker, 2014; Groundwater extraction, land subsidence and sea-level rise in Mekong Delta, Environ.Res.Lett. 9.
[3] Frank Wagner, Vuong Bui Tran and Fabrice G. Renaud; Groundwater in the Mekong Delta: Availability, Utilization and Risks, in The Mekong Delta System, Interdisciplinary Analyses of a River Delta, Renaud and Kuenzer (eds.), Springer, 2012)

Vietnamese and Cambodian part of the Mekong Delta. This also applies for the drought sensitive northeast of Thailand (the Isan region), adjacent parts of Lao PDR (Pavelic et al., 2014[4]; Vote et al., 2015[5]) and Myanmar's central plain (McCartney et al. 2013[6]). GW is also an extremely important resource for crop irrigation, food production (notably in Myanmar, Thailand and Vietnam), industry (e.g. food processing, mining) and domestic supply for urban and rural communities. Due to rapid economic and population growth, pressures on GW in the region are increasing fast. Climate variability creates a more uncertain dimension of stress, with, for example, the recent El Niño related drought in Thailand leading to emergency measures involving the drilling of 900 wells for irrigating parched rice fields with unknown longer term consequences (Bangkok Post, 23 June 2015). The threats of climate change impacts on the region's water supply are further discussed below.

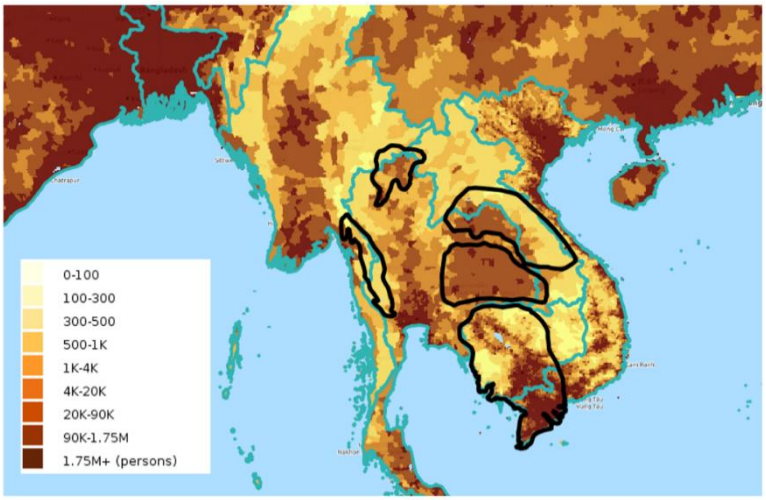


Figure 2. Main Transboundary aquifer (TBA) systems in the region and the population density in 2015 in the region (data: SEDAC: Socioeconomic Data and Applications Center).

Population densities (persons/sq. km) vary quite significantly throughout the region but it can be said that in more densely populated areas there is a significant dependency on GW for agricultural (irrigation) water needs, rural and urban water supply for domestic needs, especially in more frequent and prolonged droughts.

1.2 Groundwater resources users and increased vulnerabilities

In the recent past over-extraction of GW for production of high-value crops, such as coffee, has caused a severe drop in GW levels in parts of the Vietnamese highlands. Intensification of irrigation to meet the food demand of growing populations increases GW use while recharge diminishes. In some areas such as southern Cambodia, parts of Lao PDR and the Mekong and Ayeyarwady Deltas, naturally occurring arsenic contamination will be exacerbated by increased GW use in a changed climate. GW supports valuable ecosystem services by feeding springs and base flow to rivers and wetlands that are the habitats of fish and aquatic vegetation harvested by riparian communities.

Intrinsic linkages between surface water and GW exist, but are not always clear and must be taken into account in water allocation planning. Further expansion of irrigation, land use changes (deforestation) in the highland areas, increase of domestic and industrial use in expanding cities of the GMS may result in significant depletion of GW resources in the future, leading to reduced water availability, higher pumping costs, saltwater intrusion in coastal areas, and loss of ecosystem services. These effects will be exacerbated by the impacts of climate change (increasing demand, potentially reducing recharge) throughout the GMS. The full impacts of climate change on GW availability are likely to be complex and require further investigation.

[4] Pavelic. P., O. Xayviliya and O. Ongkeo., 2014; Pathways for effective groundwater governance in the least-developed-country context of Lao PDR., Water International; DOI 10.1080/02508060.2014.923971

[5] Vote, C.,, J Newby, K Phouyyavong, T Inthavong and Eberbach, P. 2015; Trends and perceptions of rural household GW use and the implications for smallholder agriculture in rain-fed Southern Laos. International Journal of Water Resources Development, 02/2015; DOI:10.1080/07900627.2015.1015071

[6] McCartney, M.; Pavelic, P.; Lacombe, G.; Latt, K.; Zan, A.K.; Thein, K.; Douangsavanh, S.; Balasubramanya, S.; Rajah, A.; Myint, A.; Cho, C.; Johnston, R.; Sotoukee, T. 2013. Water resources assessment of the dry zone of Myanmar. [Project report of the Livelihoods and Food Security Trust Fund (LIFT) Dry Zone Program]. Vientiane, Laos: International Water Management Institute (IWMI); Yangon, Myanmar: National Engineering and Planning Services (NEPS). 52p.

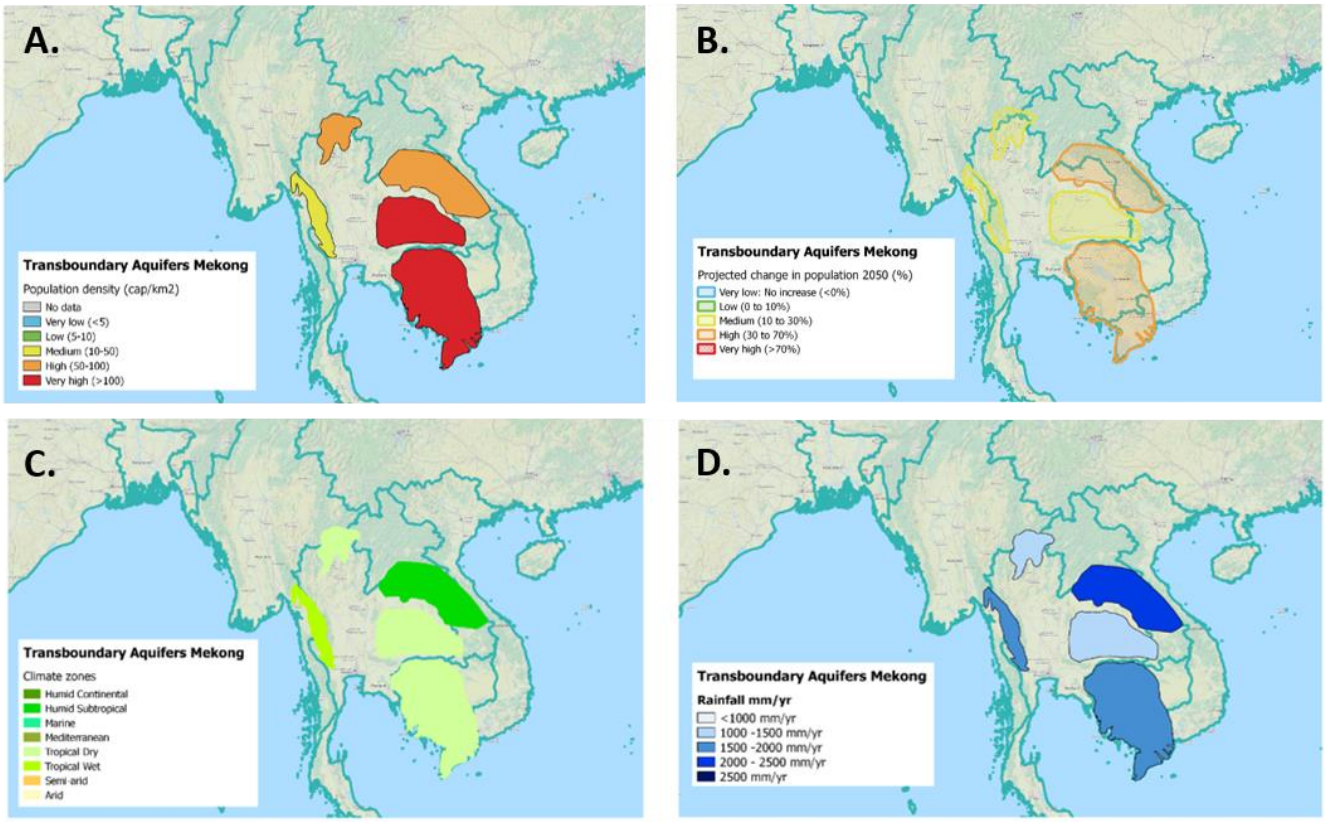


Figure 3: Overview of characteristics of the main Transboundary Aquifers located in the GMS and shared by Myanmar, Thailand, Lao PDR, Cambodia and Vietnam. A. Population density; B. Projected change in population; C. Climate zones and D. Average annual precipitation. Data derived from the Transboundary Water Assessment Programme (TWAP), http://twapviewer.un-igrac.org).

Comprehensive GW management and specialized studies are a relatively new and underdeveloped domain, pertinently so in Lao PDR, Cambodia and Myanmar. In Thailand the Department of Mineral Resources-Division for GW Management has, over the last decades, made substantial efforts to map GW resources (1:250.000 series hydrogeological maps / GW maps) throughout the country and conduct various regional and specialized studies. Besides major studies in the Bangkok metropolitan region important work also was done in the drier northeast of the country (Isan region) where agriculture relies heavily on GW. In a similar mode, systematic GW mapping and studies in Vietnam have progressed since early investigations in Red and Mekong River deltas and development of expertise and capacity in central government agencies under the Ministry of Natural Resources and Environment (MONRE). GW is now a recognized component in studies for provincial and municipal water supply and there is growing awareness on long-term supply and water quality issues (arsenic, salinity intrusion, pollution in urban areas). Unfortunately, the situation is very different in Lao PDR and Cambodia where GW is a rather neglected resource. Only gradually it is considered in national water, environmental and natural resources management policies and slowly some capacity is being developed.

Monitoring

The status of GW resources needs to be monitored regularly to provide a basis for their assessment and to estimate quantities and quality. Without appropriate data collection and assessment, there can be no effective GW management. GW is monitored in many parts of the world by measuring its levels, abstraction rates, spring discharge and quality. GW level point measurements are often interpolated and combined with other data (e.g. remote sensing and modelling) to assess the state of GW resources over a larger area. Increasingly, there is active involvement in GW monitoring by stakeholders and users (see for instance Akvo Flow; http://akvo.org/products/akvoflow/ for crowdsourcing approaches to data collection); this is of particular interest for this project. There is however, a lack of GW information at the regional and local scales, which hampers assessment and informed water management in general and the use and allocation of limited GW resources for

specific purposes as intended in this project. Worldwide, organisations have taken up the challenge of setting up and supporting systematic collection of data and development of monitoring networks. One of these is the **Global Groundwater Monitoring Network** (GGMN) established and supported by IGRAC (www.un-igrac.org/ggmn).

The GGMN is an easy to use and versatile tool that provides access to and analytical capabilities for GW monitoring data. GW level data and changes occurring in GW levels can be displayed on a regional scale. Additional data layers and information are available to understand the monitoring data in a broader water-related context. The web-based software application assists in the spatial and temporal analysis of monitoring data. The system is integrated with QGIS (previously known as Quantum Geographic Information System) to process data offline. QGIS is an open source GIS that contains a variety of functionalities to analyse the data and create spatially interpolated GW level maps (see for instance: www.un-igrac.org/ggis). The tool can be used and filled with data for any specific area, and data analysis, output, maps and charts can be derived in accordance with user needs.

Ongoing GW and hydrogeological studies in the five countries by themselves are not sufficient to address water scarcity and food production vulnerabilities; a paradigm shift in GW management is required to come to a concerted effort to develop resilience based on comprehensively supporting supply-demand issues, both from GW resources (Supply perspective), as well as from water user and stakeholder perspective (Demand). Much more than in the past, GW experts need to be aware of user needs, and possibilities and constraints to sustainably use GW. At the same time, farmers, water supply managers, industrial plant managers and other users have to be informed and enabled about the (im)possibilities of GW use, surface and GW co-management practices and other measures to support development of more resilient irrigation, food production and water supply systems. This paradigm shift can be illustrated on different levels, from very basic to strategic policy-making levels, by the use of more appropriate information products. Traditionally, hydrogeological or GW potential maps do not provide very clear or pertinent information to water users in different sectors (agriculture, industry, domestic water supply) who develop and manage water supply. In order to use the resource more efficiently, in view of increasing demand and scarcity, this can be improved. On a higher level, GW resources are now more commonly seen as an intrinsic part of the water system and correctly so; GW resources are of strategic importance for national agriculture and food systems, energy systems, ecosystem services, rural and urban water supply and obviously, evolving climate change adaptation (CCA) strategies. Hence, appropriate GW information is of strategic importance on a (supra)national level and particularly also for transboundary water issues (as in the GMS). In this project, focus will be on addressing water user needs in various sectors and jointly developing resilience measures, and on strengthening strategic GW management and transboundary cooperation.

Groundwater use

Across the GMS GW plays a major role to supply water for domestic, agricultural and industrial use, with a major share going to irrigation in rural areas and to industrial-domestic water supply in urban areas. Agricultural users commonly use surface water from streams and ponds as well as GW from shallow tube wells. GW is easily exploited by individual farmers due to general availability, quality and relative low development costs. Pavelic et al. (2015) describe different typologies of agricultural GW use in Myanmar Dry Zone; these are representative for the wider region.

- Deeper tube wells (larger farmers)
- Shallow tube wells and permanent (deeper) dug wells
- Seasonal dug wells in riverbeds
- Shallow dug wells and ponds for small extractions

Increasingly, GW is exploited, via deeper tube wells, in government-supported domestic water supply programmes for villages and smaller towns. These schemes are often hampered by poor management. Large scale irrigation schemes using GW have been developed with international technical assistance. Whereas normally large industrial water users would use surface water (sugar mills, cement factories), increasingly there are shifts to reliable, good quality GW.

1.3 Climate change scenarios and climate change impacts in the region

All GMS countries are vulnerable to the adverse effects of the existing climate and weather patterns; flooding and heavy monsoon rains are common but the region can also experience prolonged dry season droughts with pronounced and common water scarcity. Drought and water scarcity are the dominant climate-change related threats in Myanmar's Dry Zone (McCarthy et al., 2013[7]), with major impacts on the regional and national food security. Rather similar patterns are known from north-eastern Thailand and the adjacent lowlands in Lao PDR, and from southern lowland Vietnam. The tropical monsoon climate in the region is characterized by two major seasons. The monsoon occurs from May to October, with heavy rains, high humidity and strong winds. From November to April is the dry season, with little rain, low humidity and not much wind. Total rainfall across the region varies from extremely high (up to 5000 mm annually) to a mere 700 mm per year in the central Dry Zone of Myanmar. These recurrent dry spells constitute a constant threat to the livelihoods of the rural poor. The climate is influenced by the El Niño Southern Oscillation, which causes inter-annual variations, bringing warmer, drier winters in El Niño years and cooler than average summers in La Niña years. Temperature records show an increase in mean annual temperatures and the number of dry, hot days annually. Future projections suggest that these trends will continue, with the average annual temperature rising by 0.7-2.7°C by the 2060's and 1.4-4.3°C by the 2090's throughout the year (depending on the greenhouse gas emission scenario and the climate model used).

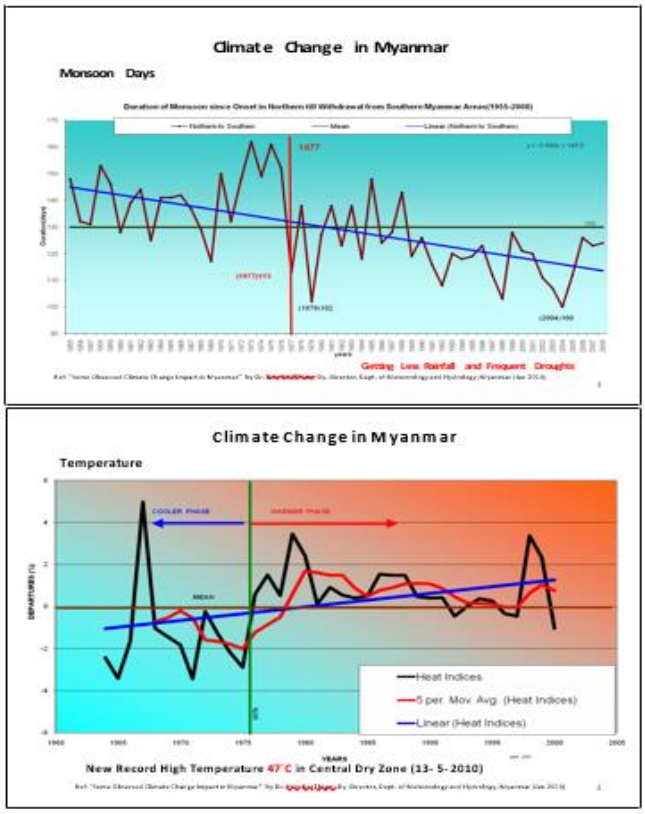


Figure 4: Climate change trends in Myanmar's Dry Zone: Rising dry season temperatures and shorter rainfall periods.

Climate models predict a minor increase in annual rainfall in the coming decades but with notable regional and seasonal differentiations. Generally speaking, it is expected that shorter and wetter rainy seasons will occur, with longer and drier dry seasons, and more anomalous seasonal events, such as the occurrence of short droughts during the rainy seasons. Together, these impacts mean increased uncertainty in the availability of water for domestic and agricultural users. Given that the climate will be increasingly variable, with more pronounced extremes, the impacts of climate change will be evident primarily through extremes in the water system, which have significant implications for different sectors and water users. (Johnston *et al*., 2010[8]).

[7] M. McCartney, Paul Pavelic, Guillaume Lacombe, Khin Latt, Aung Kyaw Zan, Kyaw Thei, Somphasith Douangsavanh, Soumya Balasubramanya, Rajah Ameer, Aye Myint, Cho Cho, Robyn Johnston and Touleelor Sotoukee; 2013; Water resources assessment of the Dry Zone of Myanmar; Technical Report, International Water Management Institute,

[8] Johnston, R., Lacombe, G., Hoanh, C.T., Noble, A., Smakhtin, V., Suhardiman, D., Kam, S.P. and Choo, P.S., 2010; Climate Change, Water and Agriculture in the Greater Mekong Sub-Region. International Water Management Institute Research Report 136

1.4 Transboundary resource management and regional cooperation

Climate change and climate change vulnerabilities are not bounded by national borders. Likewise, GW resources are crossing state borders, including in the GMS. Accordingly, both climate change related vulnerabilities and resilience measures involving GW resources have to be assessed and managed at the appropriate (regional and at least aquifer-wide) scale. Besides assessment and characterization of GW resources, this should include environmental, socio-economic and policy/ institutional aspects. In the case of internationally shared aquifers and resources used on both sides of the international border, information management/sharing and international relationships are two additional very important aspects to be taken along in the assessment. In various ways, these aspects also affect resilience based on GW use; significant changes across the border (increased pumping, pollution, etc.) may increase vulnerabilities to changing climate. (Even when that it is not immediately evident, it should be proven by monitoring and assessment because of intrinsic sensitivities in international relationships.). Once the aquifer sharing states agree to jointly manage GW resources, they need to set up an international cooperation mechanism.

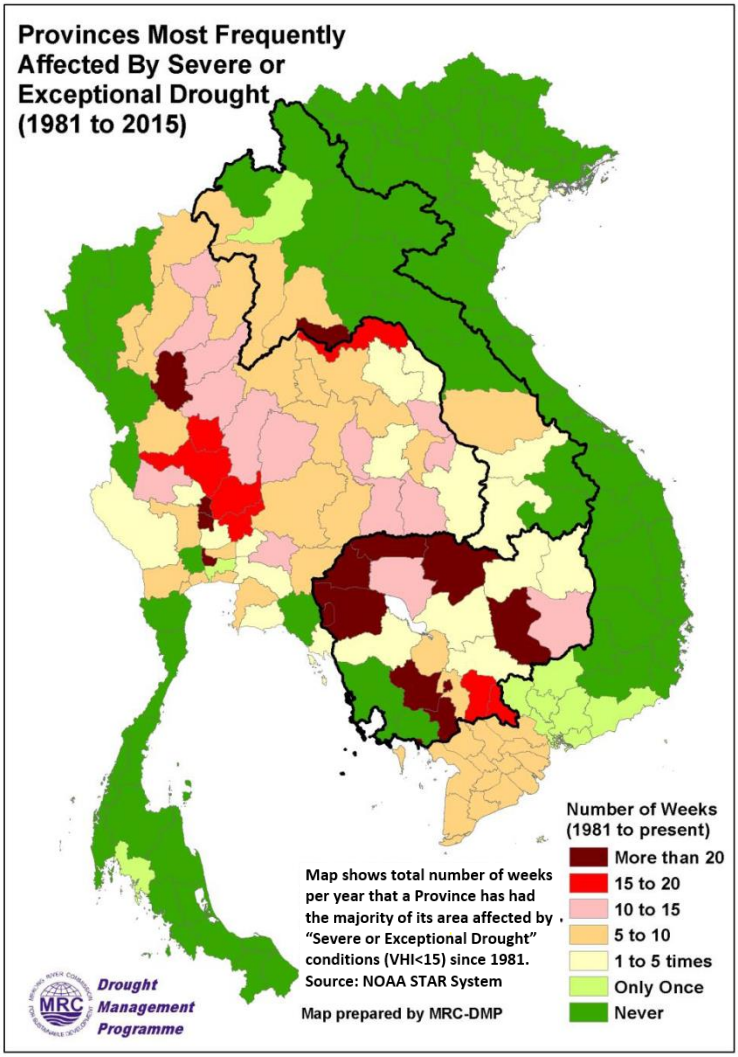


Figure 5: Regional impact of droughts (Source: MRC.org). With changing climate, the frequency of exceptional drought tends to increase (e.g. Vietnam's 2016 drought was recorded the worst drought in almost 100 years; (UNICEF, 2016[9])).
The project proposes to work in three of the most vulnerable regions, viz. the Vientiane Plains (Lao-PDR-Thailand, bordering Mekong River, the border area between northwest Cambodia and Thailand, and the upper Mekong Delta region shared by Cambodia and Vietnam.

Common monitoring and assessment usually face the challenge of data harmonization, including reference systems, formats, classifications, languages and/or technologies. Harmonized data and information should preferably be stored in an on-line Information Management System (IMS) along with outcomes of assessment and possible management scenarios. An IMS supports collection, storage, processing, visualization and sharing of data and information. As such, it is a valuable tool in management and protection of internationally shared aquifers. Moreover, contemporary IMS can easily store and combine info from various web-based sources, allowing analysis of GW resilience in a broader context of climate change (i.e. including surface water, land use, demographic predictions, etc.).

[9] UNICEF, 2016. Vietnam, Humanitarian Situation Report #2, https://www.unicef.org/appeals/files/UNICEF_Vietnam_Humanitarian_SitRep_3_June_2016.pdf

Role of Mekong River Commission

The Mekong River Commission (MRC) has built up a long track record in contributing to regional water resources management in support of broader socio-economic development and sustainable management of natural resources. The most recent MRC Basin Development Plans[10] provide a comprehensive, integrated water resources management based framework. Unfortunately, with respect to GW issues the role and mandate of the MRC is less well documented. Logically, it could provide an initial platform for regional transboundary GW cooperation, for instance focusing on a number of priority issues, such as:

- Monitoring and data sharing
- Information sharing and a joint approach to deal with high arsenic concentrations
- Inclusion of GW resource assessments and potentials in future Basin Development Plans and other challenges that require dealing with surface and GW in a conjunctive manner

This project will develop the functionality and *modus operandi* that could, potentially, be transferred to MRC as a more permanent entity with a regional water resources advisory mandate in the GMS.

Integrated Water Resources Management-based Basin Development Strategy 2016-2020 For the Lower Mekong Basin

Today, the LMB is home for 65 million people, 80% of whom live in rural areas dependent on agricultural livelihoods. Many are poor. All countries are expected to have reached middle-income status by 2030. The Mekong contributes significantly to this growth through the opportunities it provides, including water and wastewater services, energy, agriculture, fisheries, transport and trade, and ecosystems services. But without coordinated development and effective management, the Mekong can also threaten continued growth through the risks that it brings, including the risks of floods and droughts, the deterioration of water quality, the reduction of sediment loads, and the overall deterioration of ecosystem services and biodiversity. The BDS 2016-2020 recognizes these trends, takes a long-term outlook, and examines longer term water resources development needs. It is assessed that the current national water resources development plans are sub-optimal from a basin-wide perspective. These plans fall short in protecting key environmental assets and protecting millions of increasingly affluent people against major floods (and droughts). Finally, the distribution of the benefits, impacts and risks from planned basin development may not be viewed as equitably distributed.

Figure 6: The recently published Basin Development Strategy (MRC, 2016) focuses on Mekong River basin surface water resources, while there is increasing awareness that a significant share of water needs for irrigation agriculture, domestic and industrial water supply are met by supplies from GW sources. Obviously surface and GW systems are intricately linked, in particular when it comes to addressing the impacts of climate change. This project aims to develop explicit resilience potential on the basis of improved GW management, in conjunction with the regional development ambition.

Even where transboundary cooperation in surface water management (Mekong River and MRC) has progressed, there is no common approach or even modest recognition and cooperation for GW resources. The challenges in river management (resource sharing, impacts of river management and hydropower development, climate change, etc.) are equally valid for GW resources and their diverse users. The absence of a sizeable community and cooperative network of GW experts in the GMS severely hampers addressing these issues, in particular in Myanmar, Lao PDR and in Cambodia, where local capacity in hydrogeology is very limited. Regional cooperation in the ASEAN Economic Community offers an opportunity to tackle these challenges.

[10] Integrated Water Resources Management-based Basin Development Strategy 2016-2020 For the Lower Mekong Basin, MRC.; http://www.mrcmekong.org/assets/Publications/strategies-workprog/MRC-BDP-strategy-complete-final-02.16.pdf

Information Management Systems for Transboundary Groundwater

The Global Groundwater Information System (GGIS) is an interactive, web-based portal to GW-related information and knowledge. The main purpose of the system is to assist in collection and analysis of information on GW resources and the sharing of this information among water experts, decision makers and the public.

IGRAC has provided Information Management Systems (IMS) to a variety of GW projects. Those IMS are designed to store interpreted and processed data from the assessment of the GW resources in order to be used as a tool to support decision makers and to create transparency between the (international) stakeholders. The project IMS can be set up in such a way that they facilitate sharing of data between project partners only, and/or with the general public.

A new IMS can be developed as a stand-alone application or, if preferred, further integrated with existing modules available in the GGIS. In the last years, the GGIS has demonstrated its capacity in transboundary aquifer assessment projects. Shared information systems among countries have facilitated joint management and better GW governance focused on coordination, scientific knowledge, social redress and environmental sustainability.

GGIS Portal capabilities:

1. Store variables, thematic maps and documents.
2. Visualize geospatial data and information in a map viewer.
3. Share and analyse results in a protected environment before making it publicly available.
4. Add map layers from external sources via web map services (WMS).
5. Generate new pieces of information by creating overlays of thematic maps.

Meta Information Module
Maps are an excellent tool to communicate spatial data and information, but metadata related to the map layers is of equal importance. Therefore, the GGIS also contains a meta-information module which allows uploading, storing and searching of additional information linked to the data presented in the system, like documents or references.

1.5 Knowledge and information gaps

There is limited and regionally incoherent information on GW resources of the GMS, in particular the kind of insight required to deal with pressing issues, such as:

- Extent and/or characteristics of superficial and confined aquifer systems, including useable resource volumes in aquifers systems in the GMS, existing and/or potential water quality threats.
- Current GW volumes being abstracted for various uses; future demand scenarios for irrigation, urban and rural water supply.
- Relationships between recharge in highland (upstream) areas and resource potential in lowland (downstream) areas. This includes the GW dynamics of several important transboundary systems. Climate change, land use changes and major interventions in the river systems (dam and reservoir construction, upstream water diversion and flow regulation) will affect these delicate balances in supply and demand.
- Sustainability (in view of increasing abstraction) and vulnerability of riparian GW resources to climate change induced changes in precipitation and changes in river flow regimes (natural or anthropogenic).

To understand better the resource and resilience potentials and vulnerabilities of GW systems of the GMS, detailed hydrogeological investigations are required. Crucial GW monitoring data are needed to keep track of resource status and detect possible critical depletion, for developing and using regional GW information systems and for understanding transboundary GW flows. These regional (transboundary) GW models and information tools will help manage and conserve resources. It is therefore also necessary to:

- Visualize (in maps) regional and transboundary GW (recharge and extraction) systems and enable assessment of GW recharge rates from flooding and rainfall under the current and future climate conditions.
- Determine GW resource potential in shallow and deep aquifer systems (for different users) and demonstrate how this potential can be developed to increase resilience.

1.6 Capacity building

The regional landscape of GW management capability and expertise is rather diverse. Especially in Lao PDR, Cambodia and Myanmar integrated and comprehensive GW management and specialized studies are rare, mainly due to a lack of well-trained and experienced experts. At the same time, the recognition of GW as a key natural resource is beginning to reach higher policy levels in government. Fortunately, the situation has been very different in Thailand and Vietnam where GW work took off decades ago and became part of natural resources and water agencies' mandates. Subsequently, also professional training and research activities took place. In Thailand, there is a fairly good understanding of the most important national GW resource systems, viz. those underlying the central-north Chao Praya plain and metropolitan Bangkok, and more diverse and problematic aquifer systems in the northeastern Isan region. In this region, irrigated agriculture relies significantly on GW and now there is a considerable number of well-trained hydrogeologists and irrigation experts that know how to deal with GW. In Vietnam, agricultural development work in Red and Mekong River deltas has resulted in a fair degree of capability in central government agencies in the north and south of the country. In a growing community of experts, there is increasing awareness on the need to develop expertise on a number of challenging issues, like long-term urban water supply and water quality issues (arsenic, salinity intrusion) and, more recently, integrated water resources management (IWRM) to ensure the sustainability of the highly productive agricultural systems in both the Red river and Mekong River delta. Both from government and academe in Vietnam there is ongoing and high-level awareness to further develop human resources capacity through higher education and participation in national and international research. There is also a willingness to engage and collaborate with neighboring countries.

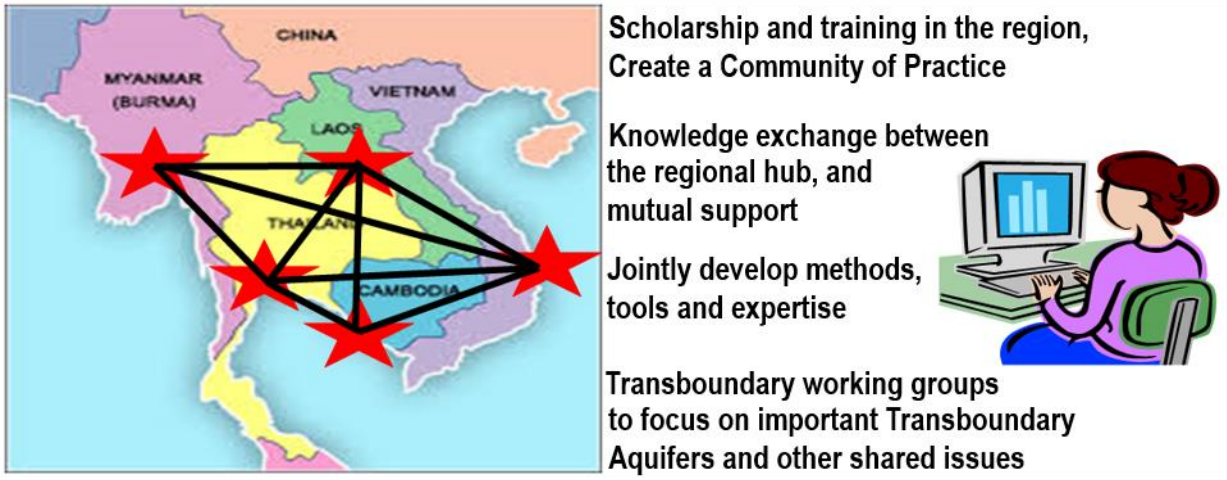


Figure 7: Regional cooperation will improve coherence, sustainability and embedding of project outcomes. It will also be the foundation for capacity building and knowledge transfer in the project.

This project will make use of the professional and political momentum (the processes that are part of the drive for ASEAN economic integration and cooperation) to build a GMS community of cooperation for capacity development in GW management. Strengthening of capabilities can take place throughout the region, but will be most explicit in the three countries most in need, i.e. Lao PDR, Cambodia and Myanmar. It will start with a verification and inventory of basic GW relevant skills and practical knowledge and general information on the size and qualifications of the practitioners, and their institutional context. Subsequently, capacity building efforts will be directed towards at least three generic issues:

1) Supporting capacity development of GW professionals towards better understanding and apprehension of new technologies that need to be engaged to ensure GW-based solutions and support for climate resilience. Examples are understanding and application of IWRM principles, (ground)water governance, GW monitoring and information systems, issues of transboundary GW management, new concepts and technologies like managed aquifer recharge (MAR), co-management of surface and GW, stakeholder involvement for data collection.

2) Enhancing the skills and understanding of GW stakeholders. GW professionals should practice and be aware of the fact that the resource with many stakeholders; farmers need irrigation water, rural communities and towns need water supply for domestic use, industries and mining operations need process good quality water, and GW is intricately linked with other valuable ecosystem services. Comprehensive and good GW studies and management should cater to all these interests and wide diversity of stakeholders. All these stakeholder groups can also develop climate resilience measures through responsible and forward-looking GW use. This will be explicitly addressed in Components 2 and 5 of the project.

3) In order for this approach to be successful, it is also necessary to have better awareness and understanding at higher policy levels. First, an assessment will be undertaken of the basic responsibilities and tasks for GW management as an important resource are in place on national government level. Second, policy development and linkage to other sectoral policies can be supported and broadened to explicitly include issues of climate resilience, sustainability and vulnerability reduction through more active GW management. Political awareness will be built up.

The project will engage the regional approach so that countries with a relatively advanced position (viz. Thailand, Vietnam) can take a leading role, share experience and lessons-learned. Additional international expert support will be provided. The project will organize and conduct a number of training workshops, with regional participation (Component 5: Training Activities: see Part II, Section A, Component 5). The degree in which national and/or regional specialized training is available will be assessed and collaboration opportunities set up. Where useful training courses are offered, project participants will be selected and invited to enroll.

The project will generate important data, information, knowledge and linkages. It is intended to facilitate these functional linkages by means of an on-line knowledge management and information repository. First, the functionality will be built-in in the project website, but gradually expanded to become a dedicated information and resources sharing tool.

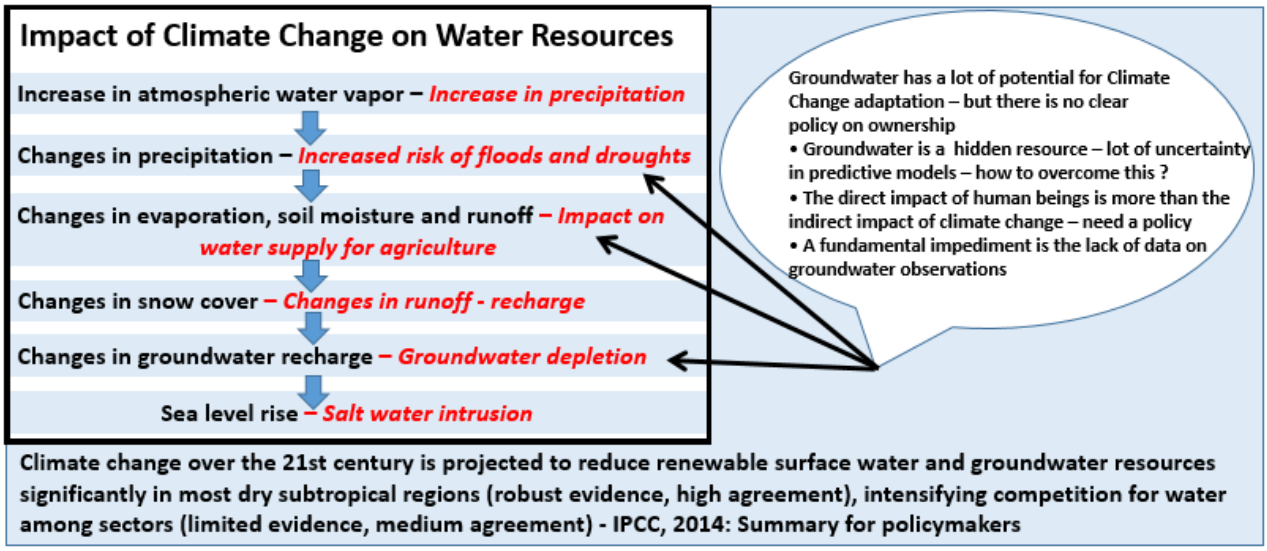


Figure 8: Earth and water resources systems are affected by the impacts of climate change. By virtue of its intrinsic properties the GW system has considerable resilience that can be developed and used to benefit water users and other stakeholders. This needs to be done with the utmost care, resource depletion following unsustainable use and mismanagement (because of a lack of guiding / monitoring data) are serious impediments.

Promoting gender equality

Ensuring access to clean and safe water to marginalized/vulnerable groups and to women is a global challenge for the achievement of Sustainable Development Goal 6 (SDG 6), particularly in developing and least developing countries (LDC). Global estimates suggest that 159 million people still collect drinking water directly from polluted

surface water sources[11]. In the GMS, more than 25% of the population in the LDCs (Cambodia, Lao PDR and Myanmar) have limited access to basic drinking water and sanitation services. This lack of access is primarily associated with the poorest communities, often situated in remote upland regions and comprised of indigenous community groups. Improved GW access can more broadly assist to not only improve health and hygiene, but also reduce poverty and malnutrition and improve livelihoods. Improving the water source through the drilling of boreholes to provide clean and reliable GW is the key form of intervention to achieving SDG 6 for each of the GMS governments and their development partners. However, the success of these programmes are greatly constrained by multiple issues that this project will seek to address.

Improved access to clean and safe GW is of particular importance to women and girls in unsafe/polluted environments in the GMS. For instance, women and adolescence girls have special needs for hygiene and access to clean water. Women who lack safe water are more prone to water borne diseases, which, when occurring during pregnancy, can negatively impact the health and survival of both mother and infant. Enhanced access to information and active women's involvement in decision-making process will enable women to benefit from access to clean GW and improve their quality of life. With improved local access to clean GW, women will face less burden in water collection and thus have more time to undertake income-generating activities and increase the productivity in agricultural sectors dominated by women. Raising awareness and increasing women's capacity on shared aquifer management will provide more opportunity to articulate women's demands for clean and safe water and develop women's leadership in local water-related decision making.

The project will provide local authorities and other decision makers working closely with women, particularly ones from marginal/vulnerable groups, with site-specific GW development measures considering GW resource status and the economic sector of the local area (agriculture, tourism, industry etc.). In the inception phase, the project will identify any gender-based vulnerabilities in the area from gender analysis and detailed fieldwork in the pilot areas. A variety of communication channels will be considered to ensure effective involvement of the poor, marginalized groups and women for receiving benefits to clean GW supply at both community-practice and policy implementation level. The project will promote women's networks to address sustainable GW management under a changing environment. Improved GW management practices and strengthened climate resilience at the community level will be realized through the local community awareness meetings and dialogues, in collaboration with relevant governmental bodies and local authorities.

Outlook

Overall, the project aims to enhance the resilience potential of improved and regionally coordinated GW management and demonstrate that it can provide effective tools and capacities to reduce vulnerability. To enhance adaptive capacity and reduce climate change vulnerability for specific target groups, the project will focus on implementing the following activities:

- Use the upgraded collective expertise and awareness of the GW community regarding CCA and resilience strategies to ensure that further work in the GW sector better supports the needs of vulnerable user groups.
- Demonstrate, further develop and ensure information is available on the 'resilience potential' of improved GW management and use (i.e. through collaborative transboundary aquifer management)
- Identify additional new vulnerability reduction options, develop these and share practices with relevant vulnerable groups (i.e. enhanced aquifer recharge practices that use wet season water surplus to create dry season reserves. These will be set up in cooperation with local stakeholder groups and under intraregional CCA initiatives).
- Ensure that new and innovative GW management information products specifically cater to the needs of the identified and targeted vulnerable groups (for instance using smart phone networks to distribute and collect information).
- Train a new generation of GW experts to think beyond the technical challenges of the physical GW system and ensure that they recognize and can respond to the multi-disciplinary and multi-sectoral nature of GW management, and are therefore able to engage with a wider range of stakeholder groups to resolve vulnerability issues and increase sustainable water use.

[11] Progress on Drinking Water, Sanitation and Hygiene: 2017 Update and SDG Baselines. Geneva: World Health Organization (WHO) and the United Nations Children's Fund (UNICEF), 2017. License: CC BY-NC-SA 3.0 IGO.

2. Project Objectives and Outcomes

2.1 Project objectives

The main project objective is based upon a combination of a number of relatively simple and straightforward concepts. In reverse hierarchy:

- There are excellent opportunities for regional cooperation and coordination to address climate resilience and mitigate threats from droughts and water shortages for food security and rural/urban livelihoods.
- GW (a "hidden resource") as an important component and integral part of the water system but not one that is sufficiently considered in general IWRM policies or in national CCA strategies
- National GW management expertise (from capable to very weak) that needs to be developed further. The national expert groups in some countries are not yet specifically oriented on the potential of GW to contribute to climate resilience and vulnerability reduction.
- The necessity to develop closer relationships between, on the one hand, GW users' groups including women and their urgent water needs for food production (irrigated agriculture), sustain rural water supply and other water demand, and on the other hand the GW community that can improve GW management and long-term sustainability and address priority needs from different end-user groups.

Bringing these considerations together, the following overall objective is obtained:

"Establish effective regional partnerships and network for sustainable use of groundwater resources as an adaptation response to protect people, livelihoods and ecosystems in the Greater Mekong Subregion (Vietnam, Lao PDR, Cambodia, Thailand, Myanmar)."

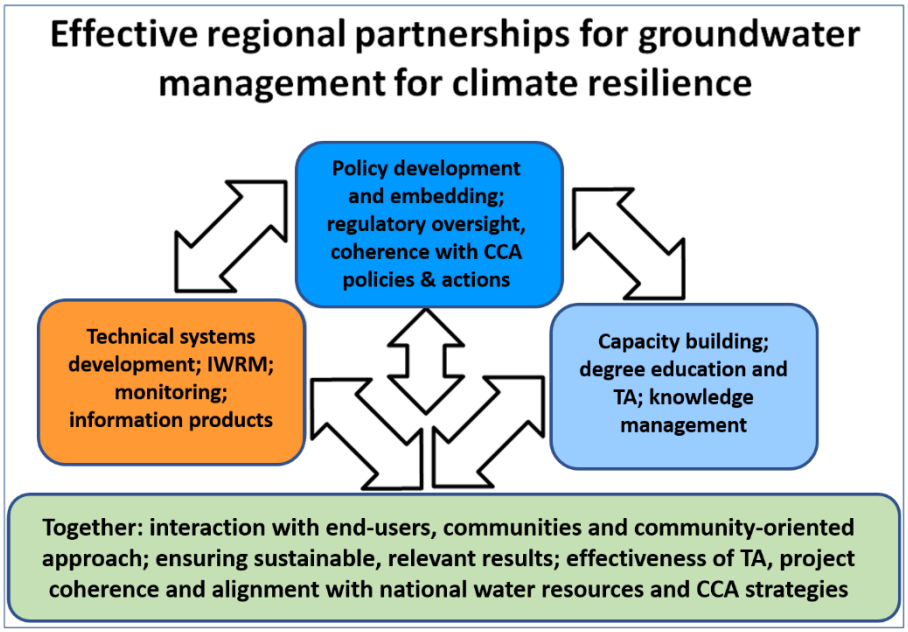


Figure 9: Departing from traditionally rather technical studies of the GW physical system (red box), with little awareness of the "demand" side (i.e. GW users), the project aims to connect GW professionals in the five countries with the current policy context of IWRM, integrated resource management, and resource use (blue box) to address sustainability issues and CCA – vulnerability reduction. In the GMS, there are excellent opportunities for collaborative capacity building and knowledge management (green-blue box to the right). The foundation for successful intervention and technical assistance (TA) lies in engagement with the GW end-users (bottom green box). Together with the different user groups (different users – different needs) CCA and resilience measures will be developed on the ground, and with recommendations for general guidelines and policy. Regional cooperation will also enable addressing transboundary issues.

Specific objectives are:

- Prepare an updated GW shared aquifer inventory for the GMS countries, develop resource management concepts and tools, and a monitoring network for GW systems.
- Understand GW recharge processes and formulate recommendations for protection and long-term sustainable management.
- Address issues of transboundary GW management also as an incentive to develop collaborative solutions
- Increase participation of stakeholders and local community including women by implementing principles of GW governance and community-level management through 1) dialogues with users to assess GW use scenarios for different sectors (agriculture, industry, rural and urban domestic water supply) and 2) develop and provide appropriate information to ensure sustainable use by different user groups (agriculture, industry, population).
- Develop and implement targeted GW vulnerability reduction measures, GW quality improvement, identification and protection of strategic GW reserves. Cross-cutting objectives will be guiding the implementation of project activities in four pilot areas and jointly generate resilience deliverables on the ground.
- Capacity building and raising standards for GW practitioners across the GMS countries and initiating regional water cooperation (diplomacy).
- High level agreement on climate resilience through strategic planning for GW resources.

2.2 Project outcomes

Project main outcomes are defined in conjunction with the five main components:

Outcome 1: Groundwater resource assessment and monitoring: A regional GMS approach to address challenges of climate change and resilience is created based on an information-based policy.

Outcome 2: Priority use and stakeholders: GW users including women from different economic sectors in the GMS have access to requisite information and guidelines and thus participate in GW management.

Outcome 3: Resource management, information tools and equipment: Climate resilience and GW use in pilot areas is increased, and low income and other vulnerable groups' needs are prioritized.

Outcome 4: Regional cooperation, coordination and information exchange: A regionally coherent policy for sustainable GW management in support of CCA is adopted based on a level playing field of all users in the GMS.

Outcome 5: Capacity building and training: GMS stakeholders and communities capably use project tools on GW use for CCA and resilience.

These five outcomes will be achieved in the four pilot areas that will **significantly strengthen the local capacity of primary stakeholders to address climate resilience issues across the region**.

Contribution to SDGs

The outcomes of this project will significantly contribute to the SDGs, including SDG 1 (No Poverty), SDG 2 (Zero Hunger), SDG 5 (Gender Equality), SDG 6 (Clean Water and Sanitation), SDG 10 (Reduced Inequalities), SDG 13 (Climate Action) and SDG 15 (Life on Land). Further, the outcomes of this project (newly developed institutional TBA management between GMS countries) also contribute directly to achieving SDG target 6.5 (Transboundary Cooperation), SDG target 6.5.2 (Proportion of transboundary basin area with an operational arrangement for water cooperation), SDG target 13.1 (Strengthen climate change resilience) and SDG target 13.2 (Improving awareness on climate change adaptation).

3. Project Components and Activities

3.1 Overview

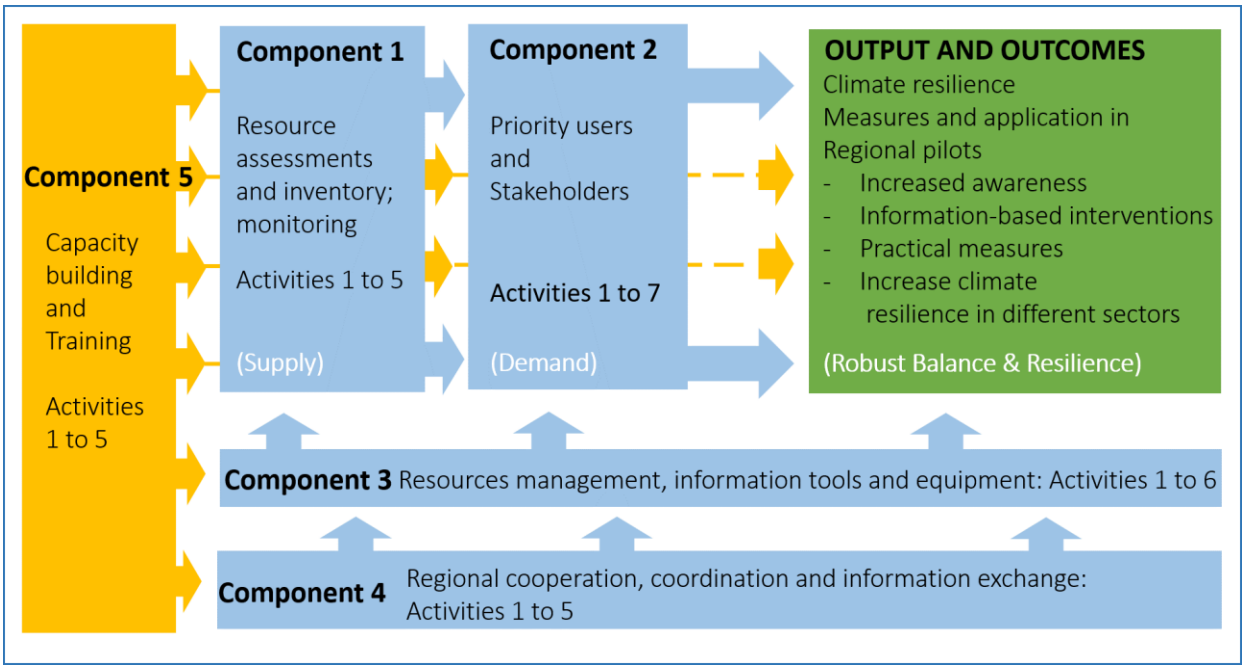


Figure 10: Schematic presentation of the project structure (four main "technical" components and one cross-cutting component for capacity building) and intervention strategy that will result in climate resilience in four regional pilots on the basis of a robust balance between GW supply and demand.

3.2 Regional pilots

The project activities as elaborated in the next sections will be centred and implemented in and associated with four regional pilots. In each pilot, the same activity format will be applied, but tailored to the local circumstances. The aim of the project is to achieve the climate resilience outcomes first in all pilot areas, and use these as examples that can multiplied across the region and used as case studies. This approach will result in efficiency gains (the effects of project resources will be multiplied) and it will also strengthen the multilateral cooperation. The following pilot areas are proposed:

1. Mekong River riparian aquifer systems (Lao PDR, Thailand, and possibly Cambodia); The Vientiane Plains, Lao PDR and adjacent aquifers in Thailand will be the preferred area. Other areas like the Southern Lao PDR Pakse region (Lao PDR – Thailand – Cambodia TBA) can also be included.

2. Upper Mekong Delta Transboundary Aquifers (Vietnam + Cambodia); Mekong Delta aquifers in Vietnam are intensively used and contribute to the high productivity agri- and aquaculture systems in the entire Delta. It is assumed that major recharge takes place in the upper delta region in Cambodia, but this TBA system is poorly understood and there is little qualitative data.

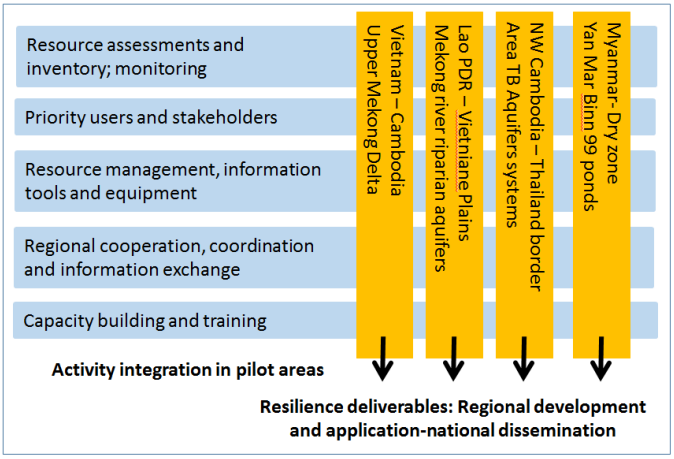


Figure 11: Project structure and activity integration in the proposed pilot areas.

3. Northwest Cambodia – Eastern Thailand border area; Transboundary aquifers in drought prone area with vulnerable rural population. GW potential supporting increased food security and rural water supply.

4. Myanmar: Central Myanmar Dry Zone, Yin Mar Bin – 99 Ponds area; The Dry Zone is one of Myanmar's most vulnerable areas to climate change. The selected area is characterized by intensive GW use, for both domestic and agricultural irrigation. There is increasing concern amongst farmers and water managers about availability of water, among others because of poor management.

Scope of Activities in the Pilot Areas

The proposed activities in the pilot areas are intended to deal with priority climate resilience issues in each area, and have a high degree of relevance to other areas with comparable physical and socio-economic characteristics in the region. Collectively the interventions in the four pilot areas have been designed and will be further detailed to contribute to the five main outcomes of the project.

Pilot area 1 focuses on the Mekong River riparian and transboundary aquifers-Vientiane Plains, Lao PDR. In the first activity, a GW management planning would be carried out. This would be the first for Lao PDR capitalizing on the increasing interest in GW resources in the country. It will be one of the major tools to support planning and decision making for the pilot area and serve as a model for other parts of Lao PDR and possibly also adjacent parts of transboundary aquifers in Thailand. This activity is divided into various tasks: (i) carrying out an inventory of the existing wells and GW use across the various districts of the Plains; (ii) consultations with a broad range of stakeholders including government officials across relevant sectors, the private sector, NGOs, and the community; (iii) tailoring regulations in consultation with local authorities and other stakeholders and (iv) awareness raising through dissemination of project findings through communication material tailored to specific stakeholders. To better serve the planning, a numerical GW flow model would also be developed and validated with field measurements and used for scenario analysis. The model would explore a range of possible development scenarios including those identified by stakeholder consultations to ensure sustainable GW management can be achieved. The opportunities for so-called bottom-up approaches to GW management processes would be explored by assessing community perceptions and interest in participatory GW management and identifying relevant entry points to compliment traditional top-down approaches.

Pilot area 2 focuses on the Upper Mekong Delta Transboundary Aquifers (Vietnam + Cambodia). The first activity would involve setting up a joint GW monitoring system between Vietnam and Cambodia. Through this collaborative exercise, the GW monitoring capabilities of the Cambodian counterparts in particular would be improved. An inventory of GW infrastructure would be prepared and GW use estimated for the various aquifer units and sectorial uses. The undertaking of these activities will form the basis for dialogue and awareness raising amongst the main stakeholders on key issues related to transboundary aquifer management and interactions between the surface water and GW systems. The information and discussion generated also serve to identify potential resilience enhancing measures in the context of transboundary integrated surface-GW management. For instance, 1) who are the most important stakeholder groups that stand to benefit, in terms of climate resilience, from improved and more active GW management; 2) to what extent is serious GW depletion occurring and can this be reversed; 3) would any GW vulnerability reduction measures (such as Managed Aquifer Recharge (MAR)) contribute to increase GW resilience effectively ?

Pilot area 3 focuses on the Northwest Cambodia – Eastern Thailand border area. The first activity to be carried out would be a joint GW resource assessment, recognizing that greater efforts are needed on the Cambodian side where very little is currently known. From the Thailand side of the border, useful lessons-learned and existent GW management practices can be adopted. A basic monitoring system would be established and necessary training to relevant agencies provided to support improved GW management capabilities in Cambodia. Through dialogue with the main stakeholders, the potential to increase GW use in support of food production and rural water supply would be explored and the best possible evidence-based case for sustainable development determined. A joint task force would be setup to develop resilience enhancing measures in the framework of integrated surface-GW management.

Pilot area 4 focuses on Myanmar: Central Myanmar Dry Zone, Yin Mar Bin – 99 Ponds area where a GW resource assessment and study of the recharge dynamics would be the first activity leading to GW management planning

(inventory of GW infrastructure and use, stakeholder consultations, GW regulations). These would dovetail into participatory-based planning and implementation of well capping and monitoring program in artesian areas to ensure the sustainability of supplies. When these initial stages have been completed, more advanced management practices will be introduced, very much like in the Vientiane Plains Lao PDR pilot (see above).

Capacity building and training activities will be included in the work packages in all four pilot areas.

All the pilots will follow the same approach and integrate activities from the five project components to generate resilience results.

Integration of all project activities in each pilot area will stimulate a balanced and output oriented way of working, without undue focus on specific studies or research.

In each of the pilot areas the project will generate specific and stakeholder-oriented, practical climate resilience measures, such as increased awareness, information on GW resource potential, GW system data and monitoring information results in order to be able to propose tailored and information-based interventions (See also Annex 1, where the resilience measures are further specified). Three of the four areas will include working in challenging transboundary aquifers systems and developing bilateral or multilateral cooperation. The available information from the different regions indicates the anticipated climate resilience measures can be targeted on different sectors. In all pilot regions, the stakeholder groups include a significant number of high-vulnerability groups.

3.3 Pilot areas description

The following section provides an overview of the characteristics and salient properties of the proposed pilot areas. The project will focus on the stakeholder groups in these areas; farmers, GW users in villages and small towns, small industries or other activities that rely on GW. Project activities are designed in such a way that vulnerabilities will be addressed and climate resilience strengthened.

A more comprehensive elaboration of the problem analysis and intervention logic for each of the four pilot regions is provided in **Annex I.**

Table 1: Overview of pilot area characterization (see also Annex I).

	PILOT AREA 1 Lao PDR-Thailand	PILOT AREA 2 Vietnam-Cambodia	PILOT AREA 3 Cambodia-Thailand	PILOT AREA 4 Myanmar Dry Zone
Location	Vientiane Plain (area ~4,500 km^2)	Upper Mekong Delta, border provinces in Vietnam and Cambodia	Western Cambodia-Thai border area	Yin Mar Bin, Sagaing, Myanmar Dry Zone (area ~900 km^2)
Rainfall/Climate zone	2,000 mm/yr Tropical Dry	1,700 mm/yr Humid Subtropical	1,400-2,000 mm/yr Tropical Dry	800-1,100 mm/yr Tropical Dry
Population density and project growth	Average to high	Very high	Average	Average
Major land use	Paddy, vegetable crops, forest, urban	Paddy, vegetable crops, cities and villages	Paddy, vegetable crops, forest,	Paddy, vegetable crops (smallholders)
Aquifer type	Alluvium bounded by sandstone on margins and at depth	Alluvium, at depth older, semi-consolidated river deposits (sand and clay)	Thin alluvium, sandstones	Artesian system. Cemented sand and gravel overlain by sand to clay alluvium
Recharge rates	200-400 mm/yr (approx.)	Vietnam: 300 mm/yr Cambodia: not known	Thailand: 200 mm/yr Cambodia: not known	Not known
Interactions with surface water	GW drains to rivers which are affected by hydropower schemes; infiltration from small reservoirs and ponds	GW recharge from river channels with high/low seasonal flow; infiltration from small reservoirs and ponds	Recharge from small rivers, ponds, small reservoirs; GW drains to rivers and Tonle Sap lake	GW recharged from rainfall in ranges to west, and possibly seepage from Yama dam
Current abstraction	Relatively low (based on the available data)	High to extremely high, deep tube wells and shallow wells	Low (Cambodia) and modest to high in Thailand	High – >1,400 tube wells in area ~777 km^2
Major purposes for abstraction	Domestic, emerging agriculture, small industry (packaged water, salt production)	Irrigation, village supply, city water supply, minor industry	Small scale irrigation, village supply	Irrigation, village supply
Water quality	Good; salinity (natural), some organic contamination	Good, some concern about arsenic levels, pesticide etc. pollution from surface water	Good, some concern about arsenic levels, microbial pollution at GW points	Generally good (possibly some problems with salinity in the upper aquifer)
Transboundary issues	Recharge from Mekong River and connectivity with adjacent Thai aquifers	Integrated resource management by Cambodia – Vietnam authorities; recharge from Mekong River (floods); pollution threats	Contrast between Thailand and Cambodia regions in utilization of resource; very limited management in Cambodia	There have been no dedicated studies for TBA assessment.
Major issues/threats GW for climate resilience	Expansion of GW use, for irrigation and domestic use, rapid urbanization, poor oversight of (possibly) large extractions	Overall volume of extractions, decreasing recharge; implications of extraction and lesser recharge for shallow domestic wells and downstream replenishment of aquifer	Non-sustainable use in Thailand; undervalued resource in Cambodia; management capabilities and better alignment with user needs	Drawdown and fluctuation of artesian water levels. Concern about wastage from free-flowing boreholes. Unregulated expansion of private wells.

We propose to execute the project in four pilot areas, each in transboundary regions. Below, relevant statistics of these areas are provided. Based on these, we arrive at an approximate number of project beneficiaries of a minimum of 5 % and maximum of 10 % of the total population, adding up to a total of around 2 million people. This number of direct beneficiaries may vary across the regions. Clarification of column headers is given below the table.

1. Pilot area	2. Provinces-districts	3. Population	4. No. of project beneficiaries	5. Vulnerable groups	6. Issues and threats	7. Economic benefits	8. Additional comments
1. Vientiane Plan, Lao PDR – Thailand			Around 8-10 % 175,000	Mixed peri-urban and rural population; low & middle income households, farmers	Expansion of GW use, for irrigation and domestic use, rapid urbanization, poor oversight of (possibly) large extractions	Improved access to water for domestic use→ lower cost of living; increased irrigated agriculture; → food supply ensured → higher incomes	Social benefits include reduced time spent by women & children in collecting water; environmental benefits for streams and wetlands supporting habitat and livelihoods
Lao PDR	Vientiane province	419,000					
	Vientiane Cap. Region	821,000					
Thailand	Nhong Khai	517,000					
2. Upper Mekong Delta Cambodia-Vietnam			Up to 10 %, mostly rural 878,000	Predominantly rural population; low & middle income households, farmers; water users in provincial towns	Overall volume of extractions, decreasing recharge; implications of extraction and lesser recharge for shallow domestic wells and downstream replenishment of aquifers	More resilient water supply for agriculture: → higher incomes; resilient water supply for domestic use: → lower costs; preparedness for prolonged drought:→ food supply ensured. Long-term resilience	In Cambodia % of villages with access to water through tube/pipe water wells is 80 %; % of villages exposed to drought and/or food shortage in the five years prior to census was 38 %.
Cambodia	Takeo	845,000					
	Kandal	1,265,000					
	Prey Veng	947,000					
	Svay Rieng	483,000					
Vietnam	An Giang	2,143,000					
	Dong Thap	1,667,000					
	Long An	1,436,000					
3. NW Cambodia-Thailand			Up to 8 %, mostly rural 396,000	Predominantly rural population; low & middle income households, farmers	Non-sustainable use in Thailand; undervalued resource in Cambodia; management capabilities and better alignment with user needs.	More resilient water supply for agriculture: → higher incomes; resilient water supply for domestic use: → lower costs; preparedness for prolonged drought:→ food supply ensured. Long-term resilience	
Cambodia	Banteay Meanchey	678,000					
	Oddar Meanchey	186,000					
	Siem Reap	896,000					
Thailand	Sakeo	552,000					
	Buriram	1,579,000					
	Surin	1,392,000					
4. Myanmar – Dry Zone			Up to 10 %, mostly rural 532,000	Predominantly rural population; low & middle income households, farmers	Drawdown and fluctuation of artesian water levels. Concern about wastage from free-flowing boreholes. Unregulated expansion of private wells.	More resilient water supply for agriculture: → higher incomes; resilient water supply for domestic use: → lower costs; preparedness for prolonged drought:→ food supply ensured	
Myanmar	Southern part of Sagaing region	(5,325,000)					
	Other part of Dry Zone						
Totals			1,981,000				

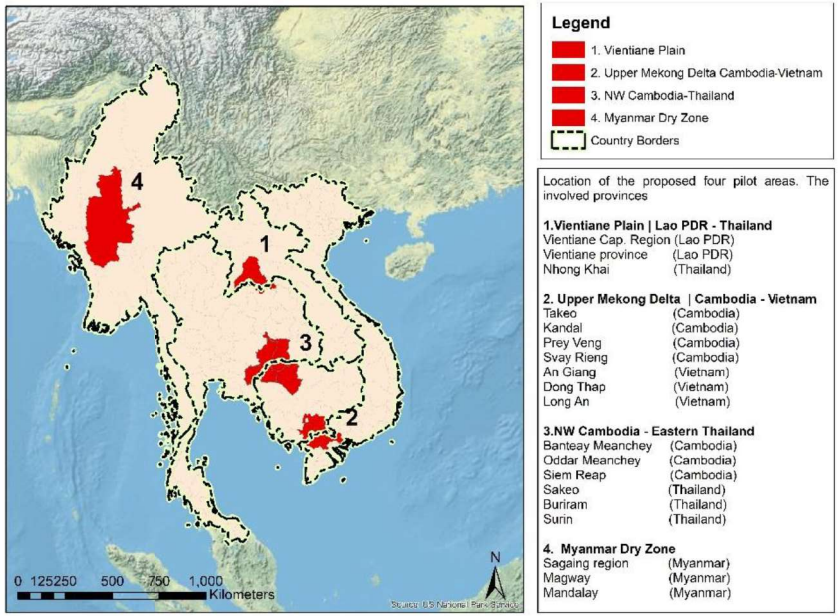
Clarification of column headers

1. –
2. –
3. **Population numbers**: Approximate total population numbers are given based on various documents and internet sources;
   Lao PDR: https://en.wikipedia.org/wiki/Provinces_of_Laos (2015 Census);
   Cambodia; Census of Agriculture report, 2015;
   Thailand: https://en.wikipedia.org/wiki/Provinces_of_Thailand & Thailand Human Development Report, UNDP (2014)
   Vietnam: https://en.wikipedia.org/wiki/Provinces_of_Vietnam; General Statics Office of Vietnam
   Myanmar https://en.wikipedia.org/wiki/Districts_of_Myanmar; Population and Housing Census of Myanmar, 2014, Summary of the Provisional Results, Ministry of Immigration and Population, Myanmar.
4. **No. of project beneficiaries;** between 5 and 10 % of the total population.
5. **Vulnerable groups;** we try to specify specific vulnerable groups (as determined by the socio-economic and physical characteristics of the area); the project will always focus on the women, children and young adults segment of the general population (over 60 %). The proposed Cambodia provinces are among the poorest and most densely populated in the country (2015 Census).
6. **Issues and threats:** as summarized in the profiles of the pilot areas (Annex)
7. **Economic benefits;** not very different across the pilot areas, but since a majority of the population is rural, improved GW management will contribute to lower cost for domestic water, improved access to water for irrigated agriculture and hence higher incomes, improved capacity to absorb shocks in water supply in times of prolonged drought. For non-agricultural, (urban) stakeholders the project contributes to lower cost for water supply and savings for water purchase.
8. **Remarks**

In addition to the characterization of the proposed pilot areas in Annex 1, an overview of the selected provinces and districts, with population density information is provided on the following pages.

Proposed pilot areas for the AF project “Groundwater resources in the Greater Mekong Subregion: Collaborative management to increase resilience”, a collaboration of Cambodia, Lao PDR, Myanmar Thailand and Vietnam to increase climate resilience in the Greater Mekong Sub-region through improved GW management and transboundary cooperation.

Pilot areas - Groundwater resources in the Greater Mekong Subregion



Location of the proposed four pilot areas. The involved provinces

1.Vientiane Plain | Lao PDR - Thailand

Vientiane Cap. Region	(Lao PDR)
Vientiane province	(Lao PDR)
Nhong Khai	(Thailand)

2. Upper Mekong Delta | Cambodia - Vietnam

Takeo	(Cambodia)
Kandal	(Cambodia)
Prey Veng	(Cambodia)
Svay Rieng	(Cambodia)
An Giang	(Vietnam)
Dong Thap	(Vietnam)
Long An	(Vietnam)

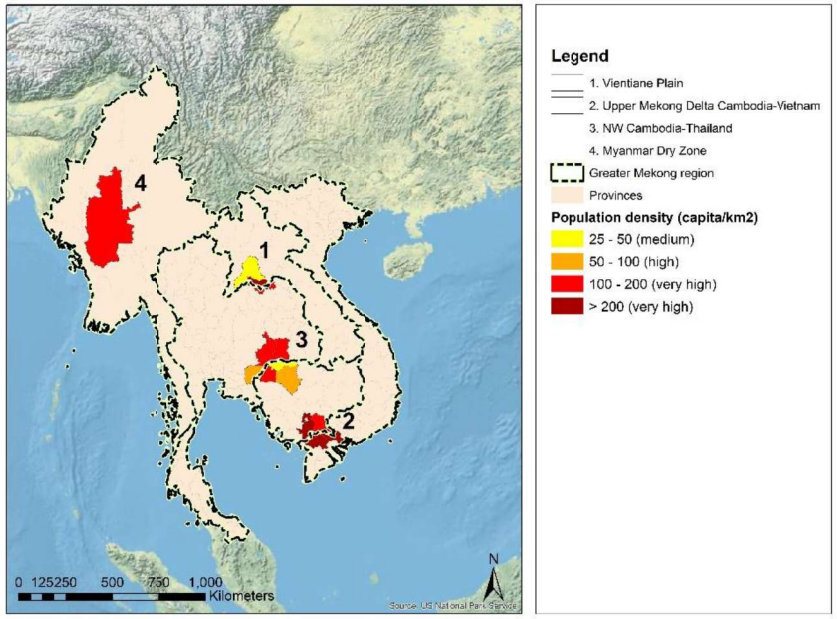
3.NW Cambodia - Eastern Thailand

Banteay Meanchey	(Cambodia)
Oddar Meanchey	(Cambodia)
Siem Reap	(Cambodia)
Sakeo	(Thailand)
Buriram	(Thailand)
Surin	(Thailand)

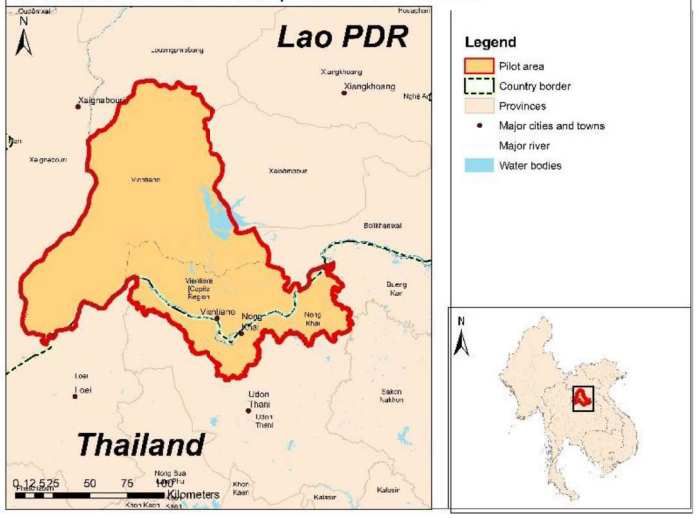
4. Myanmar Dry Zone

Sagaing region	(Myanmar)
Magway	(Myanmar)
Mandalay	(Myanmar)

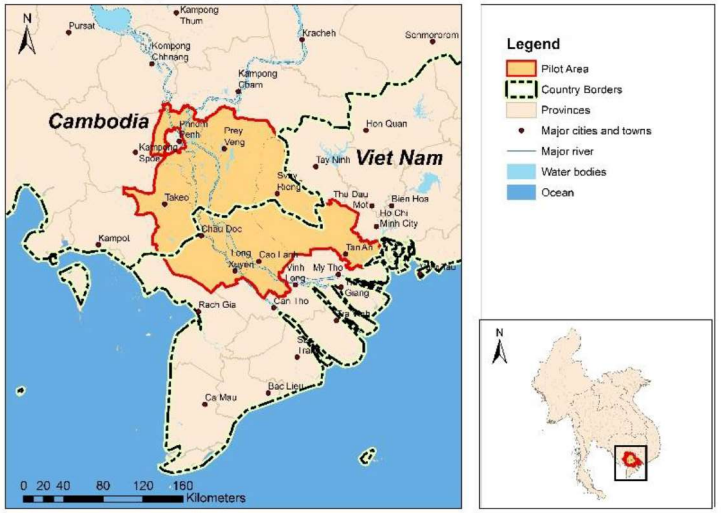
Groundwater vulnerability: Population density in pilot areas



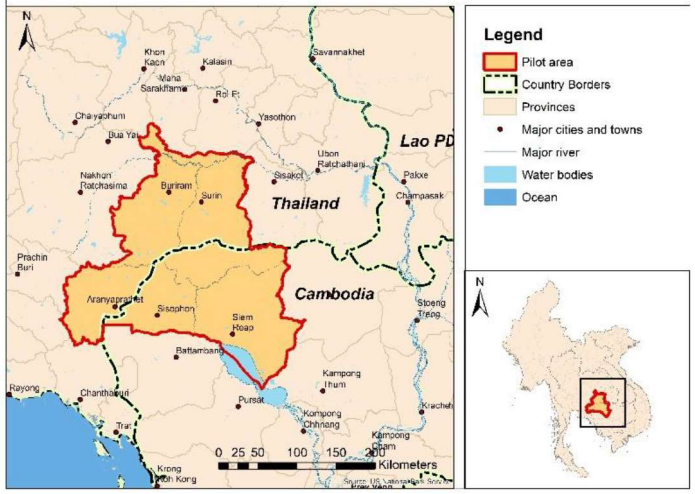
Pilot area: Vientiane Plain | Lao PDR - Thailand



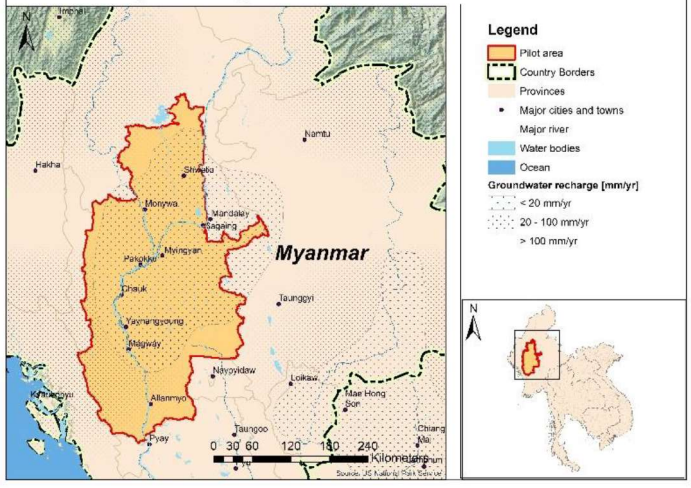
Pilot area: Upper Mekong Delta | Cambodia - Vietnam



Pilot area: NW Cambodia - Eastern Thailand



Pilot area: Myanmar Dry Zone



4. Resource Allocation and Project Finances

4.1 Resource allocation

Table 2: Principle overview of the project

Project Components	Activities	Expected Outputs	Expected Outcomes	Country
1. GW resource assessment and monitoring (US $ 1,200,000)	Updated and harmonised regional GW resources and shared aquifer inventory; GW vulnerability and resilience potential assessment; common GW systems monitoring network, with community of experts and on-line information systems are created.	Harmonised regional GW resource inventories are utilized to support regional GMS approach to address challenges of climate change and resilience; Information-based policies are enabled to manage resources and further develop new GW based resilience strategies and practical interventions.	A regional GMS approach to address challenges of climate change and resilience is created based on an information-based policy.	Cambodia, Lao PDR, Myanmar, Thailand, Vietnam
2. Priority use and stakeholders (US $ 500,000)	Dialogues with GW users including women and vulnerable groups for different sectors; develop and provide custom-made practical guidelines to attain sustainable use	Increased participation by GW users from different sectors who are aware of resource management issues and have access to information and guidelines that support more sustainable use region-wide.	GW users including women from different economic sectors in the GMS have access to requisite information and guidelines and thus participate in GW management.	Cambodia, Lao PDR, Myanmar, Thailand, Vietnam
3. Resource management, information tools and equipment (US $ 1,000,000)	Compile and integrate all collected data into the online information portal; develop and implement best GW management equipment and measures to each pilot area for vulnerability reduction and/or GW supply improvement.	Adequate collaborative resource management methods and tools made available, enabling information sharing, cooperation and mutual support across the GMS region. Information-based measures to align GW management with broader climate change resilience measures and surface water management.	Climate resilience and GW use in pilot areas is increased, and low income and other vulnerable groups' needs are prioritized.	Cambodia, Lao PDR, Myanmar, Thailand, Vietnam
4. Regional cooperation, coordination and information exchange. (US $ 500,000)	Review the GW policies and activities of the GMS countries; Organize regional workshop group between GMS countries for TBA management; Suggest institutional setup and appropriate legal framework for TBA management in GMS.	A regional cooperative network is established to exchange information and collaborate in addressing further challenges from information to policy to practice.	A regionally coherent policy for sustainable GW management in support of CCA is adopted based on a level playing field of all users in the GMS.	Cambodia, Lao PDR, Myanmar, Thailand, Vietnam

5. Capacity building and training (US $ 1,000,000)	Training workshops targeting to different GW users including women, communities and stakeholders are organized for technical and institutional supports; International conference and workshops are organized.	A GW community-of-practice created and equipped with the knowledge and skills to ensure technical and policy capabilities. Expert groups can tackle acute problems, GMS cooperation.	GMS stakeholders and the communities capably use project tools on GW use for CCA and resilience.	Cambodia, Lao PDR, Myanmar, Thailand, Vietnam
6. Project/Programme Execution cost, 8.5 % (CCOP-TS)				357,000
7. Total Project/Programme Cost				4,557,000
. 8. Project Management Fee 7.5 % charged by the Implementing Entity (MIE, UNESCO)				341,775
Amount of Financing Requested				**4,898,775**

Resource Allocation: although there will be a limited number of generic project activities the majority of the inputs will be dedicated to develop and implement the project components in each of the four regional pilots.

A breakdown of cost items for activities versus project outcomes is presented in the detailed budget, **Annex II**.

4.2 Project Calendar

Table 3: The dates of important milestones for the proposed project are indicated.

Milestones	Expected Dates
Start of Project/Programme Implementation	Jan. 2018
Inception Phase	Jan.-May 2018
Start-up of four regional pilot programmes	June-Sept. 2018
Mid-term progress workshops of regional pilots	December 2019
Mid-term Review (with Steering Committee)	Jan-March 2019
Regional project Conference and field visit	September 2020
Project/Programme Closing	Dec. 2021
Terminal Evaluation	Sept. 2021

PART II: PROJECT JUSTIFICATION

Introduction
This section of the proposal covers all items **A to L of the AF proposal format** checklist. If necessary detailed info will be provided in Annexes. Unnecessary overlap with previous sections is avoided.

A. Overview of project components

The project will consist of five interlinked components. For each component, we will define a limited number of specific activities with Results or Outputs. Outcomes (higher level results and/or impacts) as introduced in the previous section are defined at the component level. Under the five project components, each activity has a separate budget line and has inputs that include a number of cost items. Activities will be implemented at project level (generic, or GMS focus) or relate to project implementation in one of the four pilots in transboundary areas. The project is a collaborative effort of national GW agencies (and other contributing national parties) from the five participating countries with support from independent regional and international GW and climate change experts including IWMI and IGRAC.

Overall project implementation will be supported by CCOP-TS (project executive support), while project management, finance and administration. M&E, etc. are supported by the MIE UNESCO (Bangkok Office). Further details of project management are provided in Part III of this document.

The following is a summary introduction of the five main project components, with a first elaboration of the concrete activities. This project framework will form the basis for detailed work plans that will be developed at subregion level for each of the four pilots, during the Inception Phase of the project. This will be done in close collaboration with the national partners in each of the five countries.

Component 1: Groundwater resource assessment and monitoring

Outcome: A regional GMS approach to address challenges of climate change and resilience is created based on an information-based policy.

Outputs: Harmonised regional GW resource inventories are utilized to support regional GMS approach to address challenges of climate change and resilience; Information-based policies are developed to enable and support management of natural resources and further contribute to development of new GW based resilience strategies and practical interventions.

Major Activities

1. Updated and harmonised regional GW resources and shared aquifer inventory is created.
2. GW vulnerability and resilience potential assessment is carried out.
3. Common GW systems monitoring network, with community of experts and on-line information systems designed and implemented.

Activity details for GW resource assessment and monitoring

1. **Groundwater resources inventory** on basis of published data and maps, set up database and GIS tool modelled after IGRAC's tools or using CCOP GIS tool; not necessary all data in it, but especially common approach and methodology; start with countries with a lot of data (possibly existing tools, Cambodia and Lao PDR do not have much to insert.
2. **Monitoring resource status** (no data means no information and it is not possible to develop rational interventions); setting up minimum monitoring of selected aquifers (high potential, transboundary, vulnerable ones); Develop and agree on protocol to share monitoring data, select number of aquifer for active monitoring (should be active in year two to see trends year 2-3-4)).
3. **Aquifer status and vulnerability assessment;** exploitation history and trends, depletion indicators; document different examples from different countries, as examples.
4. **Resilience potential:** develop assessment framework, tentative resource classification in terms of resilience potential initially on basis of GW system properties. So where Activity 1-3 are fairly common GW resource studies, in Activity 4 we make the step towards climate resilience concepts and tools. Results will show either resilience potential (use GW to help farmers and other users to build resilience) or vulnerability or negative resilience potential, i.e., the resource status is such that it does not offer much to strengthen resilience, on the contrary, existing GW use, supporting some form of resilience, could be threatened because of depletion, pollution or other factors. When developing resilience potential always remember, (positive) resource value is different for every user group, depending on their capability or need. What is positive resilience potential for large industrial users could be negative or neutral for small farmers.
5. **Geographical coverage:** Indicated Pilot areas; selected, preferably transboundary areas with very pertinent, practical and end-user oriented approach. These areas will also feature in the other components. On the basis of results from Component 2 (Priority use and stakeholders) define tailored information products, training and awareness activities, coaching and guidance (to farmers, vulnerable groups or intermediaries). Ultimately generate improved resilience for these areas and their inhabitants, whilst working with stakeholders who may take the findings and enable scaling up in other areas.

GW resources inventory, organizing data collection, harmonization

Besides hydrogeological characterizations, GW assessment includes environmental, socio-economic and policy/institutional aspects. In the case of the internationally shared GW resources in the proposed pilot areas, information management and collaborative international work are two very important aspects to be taken up. Common monitoring and assessment usually face the challenge of data harmonization, including reference systems, formats, definitions, classifications, languages and/or use of different technologies. Therefore, one of the issues to enable collaborative management is to harmonize the hydrogeological information in the selected pilot areas. This will support a common regional view of the GW resources in the Mekong, providing a basis for collaborative actions, such as monitoring, pollution prevention and balanced use.

Aquifer status and vulnerability assessment

The transboundary aquifer assessment guidelines developed by IGRAC and UNESCO-IHP can be used for the GW inventory and aquifer vulnerability assessment process. The methodology covers hydrological, hydrogeological, socio-economic, environmental, legal and institutional aspects of the GW systems and transforms those into indicators. Indicators can be used to facilitate communication between parties with very diverse levels of knowledge and professional backgrounds, one of the components towards collaborative management. The methodology also deals with challenges such as general lack of data, inaccessibility of GW information and harmonisation of data across borders. The assessment will provide the scientific and technical basis for actions and agreements, including to development of a specific action plan for the region. The methodology is based on a participatory approach to increase recognition, shared responsibility and transparency of the assessment processes. The collection, harmonization and analysis of the data on the transboundary aquifers should be carried out by a joint team of national experts from the involved countries. The joint assessment and fact-finding of the selected transboundary aquifers lay the first foundation for informed joint management.

Component 2: Priority use and stakeholders

Outcome: GW users including women from different economic sectors in the GMS have access to requisite information and guidelines and thus participate in GW management.

Outputs: Increased participation by GW users in different sectors who are aware of resource management issues and have access to information and guidelines that support more sustainable use region-wide.

Major Activities

1. Dialogues with GW users including women and vulnerable groups to assess GW use scenarios for different sectors
2. Develop and provide custom-made practical guidelines to attain sustainable use of GW

Activity details at the regional level (in the proposed four pilot areas)

1. Overview of most important GW user groups (user typologies); understanding user perspectives; defining further work packages to think about targeting different users in different ways.
2. Consult with the relevant governmental bodies and local authorities and conduct gender/poverty analysis to identify and monitor marginalized/vulnerable group in the pilot areas.
3. Information dissemination on vulnerability issues; challenges for users, most vulnerable groups
4. What GW experts can do to support users; here the results of Component 1 come in: resilience potential. How is it appreciated by different users?
5. **Resilience strengthening pilots** for different users in different locations, resilience development and demonstration. The following options will be considered:
   a. Pilot for agriculture/farmers, using small-scale MAR
   b. Pilot for regional water-supply companies that use specific information in GW management tools, making use of tools to manage resources and understand vulnerabilities and information-based resilience options; further develop resilience options
   c. Dialogues with national policymakers and experts on strategic importance of GW resources in the overall CCA discussion
      - Improve general understanding of the transboundary system
      - Clarify roles and responsibilities of local institutions
      - Information, participation and dialogue between stakeholders on both sides of the border
      - Involve local and regional authorities
6. **Geographic coverage:** Work package to distinguish different users, at different GW management levels in small pilots, but also national strategic level, focus on pertinent, practical and end-user oriented outputs (information products, training and awareness activities, coaching and guidance (to farmers, or intermediaries).
7. Give examples in workshop with different sectors, i.e. examples of water supply companies on long-term strategy in Mekong Delta, i.e. how to ensure water supply in view of multiple threats, recharge depletion, salinity intrusion, pollution, etc.

8. **Resilience Agenda** for coming years; what do users need to do and consider (**Triple A** approach: **Agenda:** what are the issues, what has priority, when do we need to act: **Atlas/database**: where are our resources, location issues, protection, overlapping claims): **interAction** Who is going to do what, how do we interact - rules of the game, who will decide? who will pay?

Active interventions

In order to have a tangible impact on the ground, the project's activity plans for the four pilot regions will focus on co-development with GW users of suitable interventions in support of sustainable use and vulnerability reduction. Foremost among these is using the wet season rainfall surpluses to resupply GW buffers to overcome dry season droughts, in other words – enhancing GW recharge. A range of technical options are available for stimulating GW recharge. Direct surface methods are among the most widely used and simplest. Depending on local conditions, water is simply spread over fields to percolate into shallow aquifers. Other methods include digging flooding pits or shafts; or 'injecting' water into aquifers through deep boreholes or tube wells from surface water bodies. GW recharge is often best accomplished as a by-product of integrated or 'conjunctive' management of reservoir and canal seepage, injection and infiltration of return flow from irrigation, enhanced infiltration of rainfall, or the simple levelling of fields or construction of small check dams. Technology aside, a managed recharge strategy strongly implies a shift to co-management of surface water and GW. These interactions are well understood in the scientific domain, but remain almost entirely separate domains in the day-to-day worlds of policy and water management authorities.

GW storage and replenishment offers a number of unique benefits, including potentially wider, more equitable access. GW (as long as there is a source of it) is accessible to anyone with the means to dig/ drill a well; an attractive option where surface water management is often highly politicized. As a CCA measure, aquifers respond to droughts and climate fluctuations much more slowly than surface storage structures, and are more resilient buffers during dry spells. The approach borrows from extensive and successful experiences elsewhere, among others in India (Table below; Source: Shah, 2009).

Table 1: Climate change and water storage alternatives.

	Small surface storage	Large surface reservoirs	Aquifer storage (BAU)	Managed aquifer storage
1. Make water available where needed (space utility)	↑↑↑	↑↑	↑↑↑↑	↑↑↑↑↑
2. Make water available when needed (time utility)	↑	↑↑	↑↑↑↑	↑↑↑↑↑
3. Level of water control offered (from utility)	↑	↑↑	↑↑↑↑	↑↑↑↑↑
4. Non-beneficial evaporation from storage	↓↓↓↓	↓↓	↓	↓
5. Non-beneficial evaporation from transport	↓↓	↓↓↓	↓	↓
6. Protection against mid-monsoon dry spell (2-8 weeks)	↑↑	↑↑↑	↑↑↑↑↑	↑↑↑↑↑
7. Protection against a single annual drought	↑	↑	↑↑↑	↑↑↑↑↑
8. Protection against two successive annual drought	↑	↑	↑↑	↑↑↑↑
9. Ease of storage recovery during a good monsoon	↑↑↑↑↑	↑↑↑↑	↑↑	↑↑↑
10. Social capital cost of water storage and transport and retrieval structure	↓↓	↓↓↓↓↓	↓↓	↓↓↓
11. Operation and maintenance social costs of storage, transport and retrieval structures	↓	↓↓	↓↓↓↓↓	↓↓↓
12. Carbon footprint of agricultural water use	↓	↓↓	↓↓↓↓↓	↓↓↓

Table 4: The overview shows four possible storage and improved ground-water management alternatives.

The analysis assigns up to five benefits or five disbenefits to each of 12 resilience considerations. The first two options, small surface water storage facilities and large surface water reservoirs are quite well known, but provide little or negative resilience enhancement. The third option, aquifer storage, represents traditional GW use (Business as Usual – BAU), with mostly intensive exploitation (and depletion) of shallow aquifer storage, without any demand-side management or systematic strategy of enhancing aquifer recharge. The fourth option, managed aquifer storage, is not widely applied yet, and will require a radical shift in thinking. It recognizes that GW demand will and can increase, but, depending on a region's hydrology, aquifer storage can sustain this increase with proactive demand side management and a region-wide program of managed aquifer recharge.

Component 3: Resource management, information tools and equipment

Outcome: Climate resilience and GW use in pilot areas is increased, and low income and other vulnerable groups' needs are prioritized.

Outputs: Adequate collaborative resource management methods and tools made available, enabling information sharing, cooperation and mutual support across the GMS. Information-based measures to align GW management with broader climate change resilience measures and surface water management.

Major Activities:
1. Compile and integrate all collected data into the online information portal for best information sharing and analysis
2. Develop and implement best GW management equipment and measures for each pilot area for vulnerability reduction and/or GW supply improvement (For more details, see Annex I.)

Activity details:
1. Using the database and GIS tool; develop a number of specialised information products that can be derived from it.
2. Revisit resilience potential: what can user do with it; how to exploit this?
3. Pilots to confirm proper GW use is a resilience strengthening option (viz. IWMI project in Lao PDR preferably in the identified transboundary aquifers)
4. Identification of best practices of conjunctive management of surface and GW based on environmental and socioeconomic aspect of each pilot area
5. Resilience strengthening pilots if necessary: actual management interventions such as MAR
6. Monitoring schemes; minimum requirements prescribed for general monitoring; for selected aquifer locations defining and agreement on monitoring set up; installation and using the first results

The collected and harmonized data and information for the GMS in general and for the four pilot areas will be stored in an online Information Management System (IMS) along with outcomes of assessment and possible management scenarios. IGRAC can provide the IMS that can operate as a data and information sharing platform between the countries and the various water sector and climate resilience actors and stakeholders, covering issues like GW resource availability, monitoring of changes and more (pro)active management supporting climate resilience. A dedicated IMS will be set up for each pilot study, and later these will be integrated into one 'GW resources in GMS Portal'. Final output will be one information portal with an overview of the outcomes of the project and database on GW monitoring observations and other tailor-made tools.

Different measures for GW vulnerability reduction and water supply improvement will be implemented depending on the environmental and socioeconomic conditions of each pilot area. In the upper Mekong delta, for instance, the different levels of understanding of the aquifer system between Cambodia and Vietnam have restricted strategic planning of GW resource management, thus extra attention will be paid to a systematic sharing of experience, in particular from Vietnamese Mekong Delta to neighbouring Cambodian Mekong Delta. Overexploitation of GW in this area has caused several issues such as seawater intrusion or land subsidence, thus instrumental measures will be suggested and feasibility of the state-of-art technology, for example, MAR will be tested to increase aquifer resilience. For Cambodia-Thailand TBAs, intensified development of GW resources is recommended here to increase availability and ensure its sustainable use, particularly in dry periods. Thus, a joint assessment will be carried out, including the suitability of water recharge/storage methods. GW monitoring network design and piloting is envisaged as well. (For more details, see **Annex I**).

Component 4: Regional cooperation, coordination and information exchange

Outcomes: A regionally coherent policy for sustainable GW management in support of CCA is adopted based on a level playing field of all users in the GMS.
Outputs: A regional cooperative network is established to exchange information and collaborate in addressing further challenges from information to policy to practice.

Major Activities:
1. Review and analyse GW policies and activities of the GMS countries.
2. Organize regional workshop group between GMS countries for implementing international consensus and guidelines concerning transboundary GW management.
3. Suggest institutional setup and appropriate legal framework for TBA management in GMS

Activity details for coordinating regional cooperation network
1. Document for all five countries the GW policies and GW management activities; what is there to learn from each other, why is it done like it is done?
2. Focus on issue of transboundary aquifers: where, what? Are there common interests. Is it possible to set up a task force to bring transboundary aquifer (water resources) management to a higher level?
3. At least two follow up workshops, making use of the results produced in the other project components (database, joint monitoring, etc.).
4. Elaborate the four selected transboundary GW systems as cases (1. Vietnam-Cambodia: upper Mekong Delta aquifer system; 2. Lao PDR-Thailand: riparian Mekong aquifers (Vientiane plains); 3; Eastern Thailand – NW Cambodia border region aquifers, 4. Myanmar Dry Zone aquifers).
5. A: Working group on sharing and co-development of tools; B: Working group on national policy and strategy.

Focus on issue of transboundary aquifers
Depending on the outcomes of the GW inventory, appropriate institutional setups and/or appropriate legal frameworks for their joint and sustainable management need to be developed. Once the interdependence of these countries has been recognized and accepted, the next step consists in establishing contact between them, both technical-regional as well as strategic-national (diplomatic) level. This step allows the exchange of viewpoints, the development of confidence and solidarity measures, the sharing of information, and the coherent, pragmatic and progressive implementation of the various operational tools. The involvement of UNESCO will be helpful for assisting in this process, by providing their advice and assistance, and by encouraging the development and implementation of international consensus and guidelines concerning transboundary GW management.

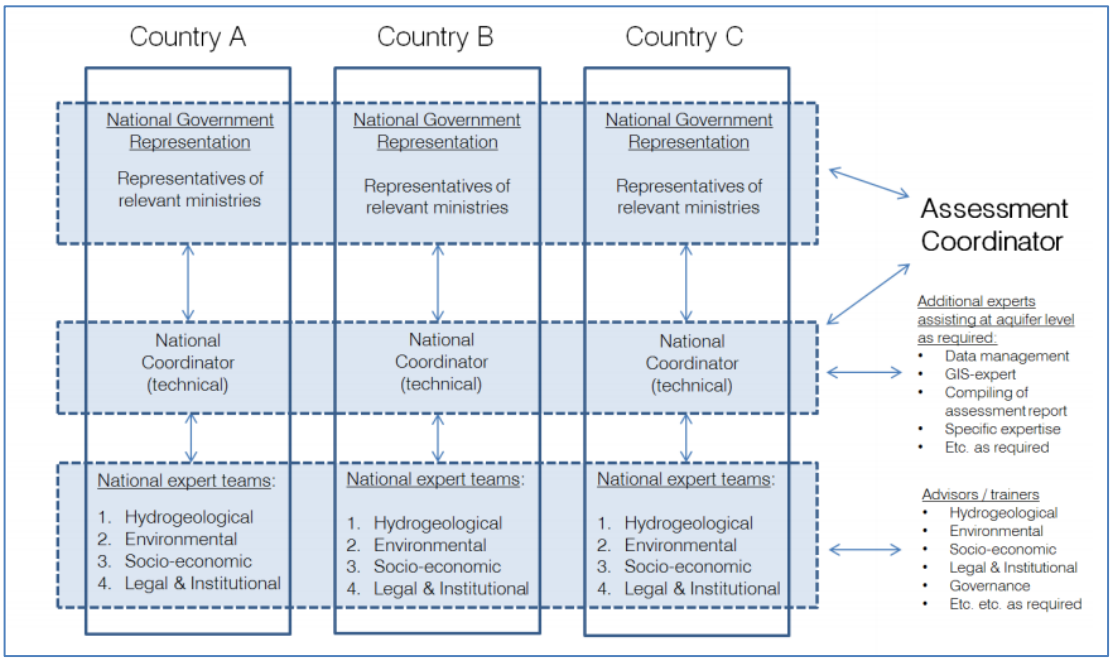


Figure 12: Example from the TBA Assessment Methodology. Executing a joint assessment will bring together experts from various regions and disciplines, one step towards joint cooperation mechanism. In this project, in order to improve the understanding of the shared aquifer systems as well as the collaborative management, the involved countries should progressively develop contacts. Preliminary technical contacts will be established by bringing officials together in regional workshops, focusing on the four pilot regions. Official meetings serve to create dialogues between the ministries from various countries to share knowledge, agree on common objectives, discuss stakes and (economic) benefits, ideas on collaborative actions and mechanisms and possibly financing issues. Source: IGRAC & UNESCO-IHP (2015).

Component 5: Capacity building and training

Outcomes: GMS stakeholders and communities capably use project tools on GW use for CCA and resilience.
Outputs: A GW community-of-practice created and equipped with the knowledge and skills to ensure technical and policy capabilities. Expert groups can tackle acute problems, GMS cooperation.

Major Activities:
1. A number of training workshops targeting to different GW users including women, communities and stakeholders are organized to provide different technical and institutional supports.
2. International conference and workshops are organized to disseminate the results of the project

Programme details for capacity building and training:
Training programmes Subcomponent

1. Training workshops (Information on the tentative scope of the training courses provided in boxes below)
   - **a.** MAR, ASR and other storage and GW potential strengthening techniques, connected to pilots
   - **b.** Transboundary aquifer management; training programme (IGRAC)
   - **c.** GGMN – the next level for the GMS; training and learning-by-doing (IGRAC)
   - **d.** Conjunctive-management of surface water and GW; training workshop with MRC experts
   - **e.** GW monitoring, developing monitoring with support of user groups
2. **Support formal training programmes**: Support to existing and/or new formal training programmes at institutes in the region covering aspects of GW management for resilience
3. Information and resources sharing and cooperation on formal training programmes in institutes, recognition of each other certificates, etc.

Learning and knowledge management Subcomponent;

4. **Information repository and Sharepoint.** The Sharepoint facility will be a publicly accessible database (Data repository) where all available data and information is stored and can be accessed. It will support taking stock of the current levels of understanding, research focus and management of GW, to assess the status of GW policies with respect to the existing and further developing knowledge base (see for instance: www.kindraproject.eu)
5. **International Conference** to disseminate the results of the project

Figure 13: Discussion with farmers on the use of tube wells for irrigation water supply. The project will be working with GW experts at various levels, but will also focus on direct interaction with stakeholder groups to extend GW use practices for climate resilience.

Workshop on transboundary aquifer management

The workshop on transboundary aquifer assessment and management will provide national experts with guidance and tools to execute the assessment in a systematic way. The workshop follows a participative approach in which the regional experts will start the joint–fact finding. Joint-fact finding assists in opening discussion, increased knowledge-sharing, and overall transparency of the assessment processes. These components are all important to reach a common understanding and to enable collaborative management. The training programme will specifically deal with and will be tailored to the selected transboundary aquifer system (one of the three pilot areas).

Content of the training

- Transboundary aquifers and their management
- Guidance for data collection and harmonization
- How to go from data to knowledge?
- Training to work with the Information Management System
- Transboundary Dialogue on GW issues and Joint Cooperation mechanisms

Training on advanced groundwater monitoring and analysis

The purpose of the training course is to train a group of GW professionals on GW monitoring networks, setting up monitoring network, and basic information on processing of the information. The second part of the training would provide the local technical consultants/researchers with modern technical skills in the use of Global Groundwater Monitoring Network (GGMN) and GW modelling tools. The GGMN provides an interactive portal for storage, processing and dissemination of GW data. The training participants will have the opportunity to acquire an active role in the GGMN Network and to continue to use the GGMN interactive portal.

Content of the training

- GW monitoring objectives and monitoring network types
- Procedures and methods of setting-up a GW monitoring network

- GW monitoring equipment
- Open source and freely available GW software tools
- GGMN Portal (Database and information management)
- Time series analysis
- Spatial interpolation in QGIS
- FREEWAT software (open source GW modelling tool in QGIS)

Conjunctive management of surface and groundwater; training workshop with MRC / National Mekong Commission experts

IGRAC will provide content for this training targeted to staff from the Mekong River Commission and National Mekong Commission members with a focus on 'Integration of Groundwater Management into Transboundary Basin Organizations'. The training course will be tailored for the GMS, and partly based on the manual on 'Integration of Groundwater Management into Transboundary Basin Organizations', developed in corporation with IGRAC, Cap-Net, Germany's Bundesanstalt for Geowissenschaften und Rohstoffe (BGR), IWMI, AGW-Net/UNDP and the former GW-MATE team of the World Bank. The manual is designed to help develop capacity within the river basin organizations to include and manage (transboundary) GW issues. A community of experts affiliated with the Mekong River Commission and National Commissions in the region provides an initial platform for transboundary GW cooperation.

Community dialogue meetings

Increasing awareness and capacity for GW management at community level are key to achieve long-term sustainability of GW use under changing climate in the GMS. In order to promote capacity building of local people in response to GW related issues, this project will implement a community level learning programme and awareness raising meeting, particularly focusing on ensuring human rights to clean water access, livelihood improvement potential of new development, responsible GW management and gender equality. For the most effective delivery of the project's outputs and outcomes to local communities, this project will consider a variety of communication/learning channels, reflecting socio-economic and indigenous contexts of the region.

UNESCO, as a specialized agency of the UN with a mandate in education, natural and social sciences, culture and communication, will apply an intersectoral and integrated strategy that encompasses both natural and social and human sciences components, by emphasizing the linkage between evidence-based GW solutions and its realization at community level. UNESCO adopts a human rights based approach as a normative principle, through which protection of human rights for the vulnerable groups in GMS will be further promoted. A close partnership with CCOP, IWMI, IGRAC, national agencies and local authorities will facilitate effective and efficient implementation of the strategy.

Content of the workshops/meetings would likely include:

- Community dialogue meeting to gain insights into local problems and priorities and to raise awareness on sustainable GW use and protection
- Community dialogue meeting on building resilience tools on climate change water-related disasters (drought) based on GW resource availability and socio-economic status of local communities
- Community learning to promote clean water/sanitation access for women and girls in unsafe environments

These events would be undertaken with the participation of key stakeholders from the water, agriculture, energy, health, environment sectors to build integrated capacity and ensure effective linkages are made with existing policies and plans.

B. Innovative solutions to climate adaptation

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

1. Climate resilience and added value of regional approach, Greater Mekong Subregion transboundary collaboration

By introducing and stimulating robust methods for resource assessment and collaborative principles for sustainable GW use, valuable water resources can be more effectively allocated for strategic and emergency purposes, thereby enhancing resilience in water supply and food production. Climate resilience is based on a broader suite of options, including limited surface water and GW, and overall use efficiency is stimulated.The regional approach creates significant efficiency gains in development of resource management concepts, tools and supporting systems and in developing the required regional human resources capacity. By developing regional regulatory guidelines for appropriate GW use, unsustainable practices are prevented equally across the region (also creating a level playing field), instead of pushing communities to compete with each other.

2. Sustainability assessment of limited and valuable groundwater resources

To increase resilience and reduce vulnerability it is essential to: assess sustainable GW extraction rates under various current and future land use conditions; develop with users “low vulnerability” land use and identify solutions to overcome high vulnerability cases; assess impacts of the current and likely future climate change conditions on the GW resources; create awareness on the potential depletion of limited GW resources; and develop fall-back options and water use efficiency measures that have a direct impact on the ground.

3. Innovative solutions to climate change adaptation; a regional approach and cost-effectiveness

The development of GW MIS for the region will provide ample opportunities to introduce innovative ICT supported data collection, information sharing and training. Direly needed GW resources monitoring in collaboration with well owners and water users provides excellent opportunities for data collection through crowdsourcing, which also strengthens stakeholder involvement.

The programme connects to national priorities for CCA, i.e. GW conservation and sustainable use, as included in respective national CCA policy documents. The programme partners are already working on related studies in the region; this earlier and ongoing work will pave the way for this new and challenging regional project.

4. An IWRM approach including groundwater and focused on farmers perspectives and needs.

Unlike many other studies and projects dealing with water resources management this intervention will apply IWRM from a GW system perspective, based on the fact that farmers and other water users almost always use (complementary) GW to cover seasonal water needs. This applies to farmers producing food and market crops, but more strongly to a large number of rural water users for domestic purposes. GW is nearly always a reliable source for low-cost and relatively good quality water. In applying IWRM principles specific attention will be paid to user perspectives, matching needs from different user groups and developing insight in what ways GW can contribute to increased resilience. This is not only different as compared to integrated (surface) water studies, but also requires a bottom-up (from the users’ side) perspective on GW resources, versus a more traditional top down (from the resource assessment side) perspective.

It is believed that especially this innovative approach will generate tangible and acceptable climate resilience support to primary stakeholders in the countryside and rural towns.

C. Project economic, social and environmental benefits

Positive environmental and social impacts, a balanced intervention with sustainable results

The program will mitigate environmental impacts of droughts on agriculture and food production, and on rural and urban domestic water supply constraints. It will also mitigate social impacts on access to low-cost domestic water supply and on rural communities' access to irrigation water for self-reliance in food production. The funding requested is allocated in a balanced way to 1) technical studies and deepening of the knowledge base, 2) dissemination and interaction with stakeholders and 3) human resources development and creation of a regional community of experts of both sexes.

The project will have positive environmental and social impacts: it will stimulate sustainable use of valuable natural resources and increase awareness on vulnerability; it will support approaches to ensure equitable access to water for food production and domestic use. It will enable conservation of scarce water resources for low-income groups. By following a regional approach also an international level playing field is supported.

Beneficiaries of the project
The project deals with providing improving the reliability, sustainability and climate resilience of GW use that directly or indirectly supports the lives and livelihoods of around 300 million people that reside in the GMS. The primary beneficiaries of this project will be the rural communities of the four pilot areas and across the GMS. The communities in the pilot areas where the project will take place will benefit from better information and understanding about the importance of GW and how it affects their livelihoods. The information generated from the project will directly help local farmers, water resource managers, agricultural extension staff, water user organizations, well drillers and potable water suppliers including men and women from vulnerable groups, to better understand the resource and its importance.

Another important group of beneficiaries from the project will be project partners from the five countries and the stakeholder groups at national, provincial, district and local levels tasked with managing the GW. We aim to build capacity for central (national) level managers through to field-level technicians from government agencies in relevant sectors along with staff/students from universities that are engaged in this project.

Vulnerable groups
The vulnerable groups in the pilot areas include resident ethnic minority goups as well as those resettled from mountainous areas voluntarily or as a result of government policy. Rural women and children incur much of the burden of fetching domestic water from GW wells in villages situated remote from clean and reliable surface waters, particularly in the more remote inland areas. Many of these communities still lack clean and reliable supplies and adequate sanitation. Using gender analysis and vulnerable group experts as well as local authorities, the socio-economic background and status of marginalized/vulnerable groups in the region will be identified in detail during the inception phase and will be monitored through the project implementation period. By identifying women and ethnic minorities as some of the key users and local champions for GW, the project will give particular emphasis to ensuring ongoing and improved rights to access GW. Consultations and training will involve women and marginalized communities engaged in or aspiring to make use of GW for domestic supplies and crop or livestock production.

Low income rural population: Traditionally, GW is an important source for water supply for agricultural and domestic purposes for low-income rural population, not connected to piped water systems or irrigation schemes. This project will improve the availability and sustainability of GW supplies and will strengthen the awareness that GW can be an important fall-back option in case of prolonged drought. The project will also introduce training and guidelines to ensure that limited GW resources are not depleted by wasteful practices such as pumping large volumes of good quality GW if surface water could be used. If such practices can be prevented or reduced it will eliminate a major threat to sustainable water supply for vulnerable groups.

Gender considerations: From rural population groups, female stakeholders will be specifically targeted in accordance with their traditional roles in food production for households and domestic water use. Within the project and the five-country participants group a gender platform will be created with predominantly female members who will actively engage with this mission. Best practices from other successful projects will be adopted (for instance,

see: Ofosu, E. A., E. Mapedza, B. van Koppen, P. van Der Zaag and R.E. Namara 2010. *Gendered access to shallow wells and riverine dugouts in the Upper East Region of Ghana*. Unpublished report.); https://cgspace.cgiar.org/bitstream/handle/ 10568/33613/8.5%20Gender%20issues.pdf? sequence=1

Among others IWMI experts[12] (partner in this project) have shown that gender-sensitive approaches to GW development and management help secure and protect access and use for women and the rural poor. Gendered water rights determine access and control over GW resources. Men and women differ in their needs and technological preferences for GW extraction and are affected differently when GW development interventions are introduced.

Reference is also made to UNESCO's (including IGRAC) support for gender equality in relation to GW management and use. See: http://GWportal.org/focal-area/gender

UNESCO-IHP (International Hydrological Programme) advocates for more equitable water resources management and human development opportunities for both women and men.

Gender equality is one of UNESCO's global priorities, with a commitment to promote equality between women and men across the Organization's mandate. Gender equality is not only a fundamental human right, but a necessary foundation for the creation of sustainable and peaceful societies.

Women represent at least half of the workforce in agriculture and food production, and often bear the daily burden of carrying water to their families. Although women play such a pivotal role in water resource management, sanitation and hygiene (especially in rural areas), gendered water data are among the least available of national level indicators, and 45% of countries do not produce any gender statistics related to water. Climate change, inadequate access to water, and poor water quality negatively affect women's and girls' health, education, employment, income, and empowerment in ways that are distinct from their male counterparts There are corresponding risks to both local and global food production and the care of livestock. Additionally, in academia, women are under-represented in hydrogeology studies mainly because of the structure of academia and historically low numbers of women entering the field.

In the project gender proactive approach will be undertaken throughout the project implementation in the four pilot areas along the lines of these best practices and other examples. The workforce of this project will be comprised considering the gender balance.

Finally, project capacity building activities and support to the GW CoP will seek a balanced attendance of female/male participants.

[12] *IWMI training programme: Gender and Institutional Approaches to Groundwater Development Management, MODULE 6: GENDER MAINSTREAMING IN AGRICULTURAL WATER MANAGEMENT;* *http://publications.iwmi.org/pdf/H042180.pdf* , and *http://siteresources.worldbank.org/INTGENAGRLIVSOUBOOK/Resources/Module6.pdf*

D. Cost effectiveness

Cost effectiveness through national agency and stakeholder contributions
The project will be implemented in close partnership with national agencies mandated with GW management and involved in supportive GW studies. Through these, there will be substantial in-kind contributions and spin-off of regional collaboration (better exchange of information, sharing of experience, joint studies, etc.). The resilience pilots will be multiplied and extended across the national territories of the five countries. Furthermore, for various proposed pilots and implementation activities there will be contributions from stakeholders, communities and local government. Although this kind of operation is organisationally complex there will be significant cost reductions and, importantly, increased ownership and awareness. For example, stakeholders and GW users will be invited to propose case studies and practical cases in which climate resilience measures will be applied and tested-demonstrated.

Cost effectiveness of technical assistance and leverage
The executive model set up for the project emphasizes regional (from the five participating countries) sourcing of many inputs for activities, and regional coordination and support from CCOP-TS. CCOP-TS has been able to organize and implement regional collaboration projects that have shown high cost-effectiveness by making use of technical support and contributions from national government agencies. Additionally, the use of peer-support and local experts from the different expert communities is foreseen.

It is anticipated that the project and its executive proponents CCOP-TS, IWMI and IGRAC will be able to leverage additional support from partners that are active in the region and the subject matter. For instance, there is current support from Australia's DFAT (Department of Foreign Affairs and Trade) for IWMI's GW work in Lao PDR, and for climate adaptation and resilience in the Mekong Delta.

1. CCOP-TS has longstanding and active cooperation with BGR. There are currently activities in Vietnam, Lao PDR and Myanmar.
2. CCOP-TS has a long standing and active cooperation with JICA of Japan. Further cooperation in this project is envisaged.
3. There is active cooperation on GW management and CCA with KIGAM, Republic of Korea (Korea Institute of Geoscience and Mineral Resources). Recently, and in preparation of this proposal, a workshop was convened with representatives of all partners from the region (*CCOP-KIGAM-UNESCO-MME Workshop on "Climate Change and Groundwater Resources in the Mekong River Basin", Sihanoukville, Cambodia, 1-4 June 2016).* An earlier workshop also served in preparation and inspiration for this proposal *(CCOP-KIGAM-UNESCO-DGR Workshop on Sustainable Groundwater Management in Mekong River Basin 19-20 May 2015, Bangkok, Thailand.* Further support from KIGAM and Korea International Cooperation Agency (KOICA) is envisaged.

The component for hardware and equipment is relatively small, and the items purchased will be for long-term use; upon completion of the project ownership of equipment will be transferred to the national agencies.

Cost effectiveness in project operations
The project *modus operandi* will be 'implementation by the stakeholders, for the stakeholders'. This means limited technical assistance support will be mobilized to develop, organize and implement activities (especially in the pilot areas) with and for the primary stakeholder, the actual and potential GW users. This will be a cost effective approach, as only overhead costs and limited time inputs will be incurred.

A similar principle will be adopted for activities on higher policy and institutional levels as it is believed that the main objectives of the project will feed directly into the main policy and operational tasks of the involved national partner agencies. It is expected that the strategic support the project can offer will leverage internal resources and create a win-win situation for the project and the national contributors.

Alternatives to the proposed solutions
The following three features are considered key to the cost effectiveness of the proposed approach and envisaged solutions. It is argued that possible alternatives, as suggested below are less cost effective.

1. A regional approach and transboundary cooperation: Alternative: a specific country focus, or specific, and different interventions in different countries.

2. Accent on bottom-up, in pilot areas, with local stakeholders and national agencies, setting up of activities and generating results and impact followed by extrapolation to policy level and possibly national application: Alternative: a top-down approach, starting with policy issues at a multilateral level.
3. Strong role of national cooperating partners and modest support of international technical assistance: Alternative: explicit external and international technical assistance support.

Ad 1. We believe the regional approach generates considerable multiplier effects and synergies. It comes at an appropriate time and connects both to the underlying theme of transboundary GW management, as well as to the active CCOP-TS and UNESCO network of GW professionals in the region. In the incipient ASEAN Economic Community, despite some traditional controversies and disputes, the region is coming together more and more. Expected efficiency gains are:

- Sharing of information, dissemination of best-practices and project results across five countries
- Identification and elaboration of comparable GW management challenges, use of similar tools and application of comparable solutions
- Closer cooperation in capacity development and formal training across the five countries, whereas otherwise it would be done in five relatively small GW Communities of Practice (CoP)
- Region-wide distribution and multiplication of integral project results, if relevant translated into national languages. Alternative, country-focused approaches would be far less ambitious and would have a relatively low impact (larger cost/impact ratio).

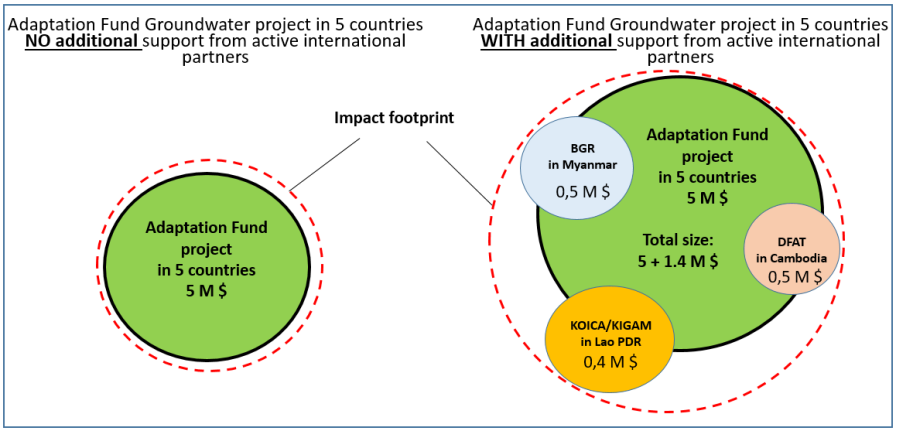


Figure 14: Leverage from AF funds to stimulate further regional and collaborative GW management for strengthening climate resilience. The project could form the core of an even larger GMS programme, with a concerted effort significantly enlarging impact.

Ad 2. We believe an alternative top-down approach would certainly contribute to improved GW management at national levels, meeting new and more appropriate natural resources management targets (in a context of CCA). But there would be a strong risk of not achieving substantial climate resilience impacts for the primary stakeholders. Our regional experience also confirms the higher effectiveness of local farmer, and/or other actors-based interventions and innovations versus government-introduced measures (top-down). By following the bottom-up approach we also aim to steer the national partners towards generating impact on the ground, in provinces, and not instead to sticking to traditional but often ineffective work processes aimed at meeting national statistical targets.

Ad 3. With increasing costs of international technical assistance both CCOP-TS and UNESCO are increasingly aware that significant cost savings can be achieved by working with national advisors and experts from within the region. This is challenging and requires strong coordination and some guidance, but can still generate impressive impacts. Furthermore, this *modus-operandi* is nowadays far more appreciated in ASEAN. We see that other projects easily involve two to three long-term international experts where this project proposes one Coordinating Technical Advisor. By more substantially involving national partners (five countries) we achieve significant cost savings while aiming for high impacts.

We are working on developing further collaboration with other potential donors (introduced above), where the rationale is that this project can act as a core project, with affiliated supporting initiatives. If this leverage is successful, the effectiveness of the allocated Adaptation Fund support would be substantially enlarged.

E. Consistency with national or sub-national sustainable development strategies

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

Economic growth and food security have been important objectives of the governments of Vietnam, Lao PDR, Cambodia, Thailand and Myanmar. Over the last decade water resources management policies also have evolved in the countries towards more integrated management and in awareness of making use of finite resources in support of achieving the MDGs, and more recently the SDGs. In Vietnam, for instance, this has resulted in the adoption of a new Law on Water Resources (2009), recognition of IWRM principles and the setting up of River Basin Management approaches for the integrated management of surface and GW resources.

In Lao PDR donor support (ADB, DFAT/AusAid) and international cooperation (GIZ, IWMI) have supported development of IWRM based policies and capacity at policy and operational level (National IWRM Support Programme, ADB, DFAT/AusAid and associated programmes). Although these policies and operational practices are far from mature, there is growing awareness, understanding and political ambition to strengthen natural resources management including GW in support of societal needs and in recognition of vulnerabilities of low income groups like small farmers. There is also a firm understanding that the impacts of climate change are not to be underestimated. In the Lao PDR the **National Adaptation Programme of Action to Climate Change (2009)** includes two main action points on GW. These are well aligned with this proposal.

For **Thailand**, the project will closely align its initiatives with the Ministry of Natural Resources and Environment and the Office of Climate Change Coordination, Office of National Resources and Environmental Policy and Planning (ONEP) as the focal point for the **Thailand Strategic Plan on Climate Change**. For the specific interventions it will coordinate with the sectoral agencies mandated to address CCA. The AF project is anticipated to contribute to the strategic objectives shown in Table 5.

Table 5: Thailand's Strategic Plan on Climate Change main strategies and anticipated AF project impact.

	Strategy	**AF project impact**
1	Build capacity to adapt and reduce vulnerabilities to climate change impacts	Focus on pilot areas to build capacity for stakeholders and institutional partners
2	Promote greenhouse gas mitigation activities based on sustainable development	Developing sustainable use of natural resources
3	Support research and development to better understand climate change, its impacts and adaptation and mitigation options	Resource assessments, study and inventories of transboundary GW systems, assessing potential for resilience measures
4	Raise awareness and promote public participation	Focus on pilot areas and preparation of targeted information products
5	Build capacity of relevant personnel and institutions and establish a framework of coordination and integration	Build capacity for institutional partners, stimulate intra-institutional cooperation (interaction MNRE – Agriculture)
6	Support international cooperation to achieve the common goal of climate change mitigation and sustainable development	Regional cooperation, information sharing, intra-regional capacity building

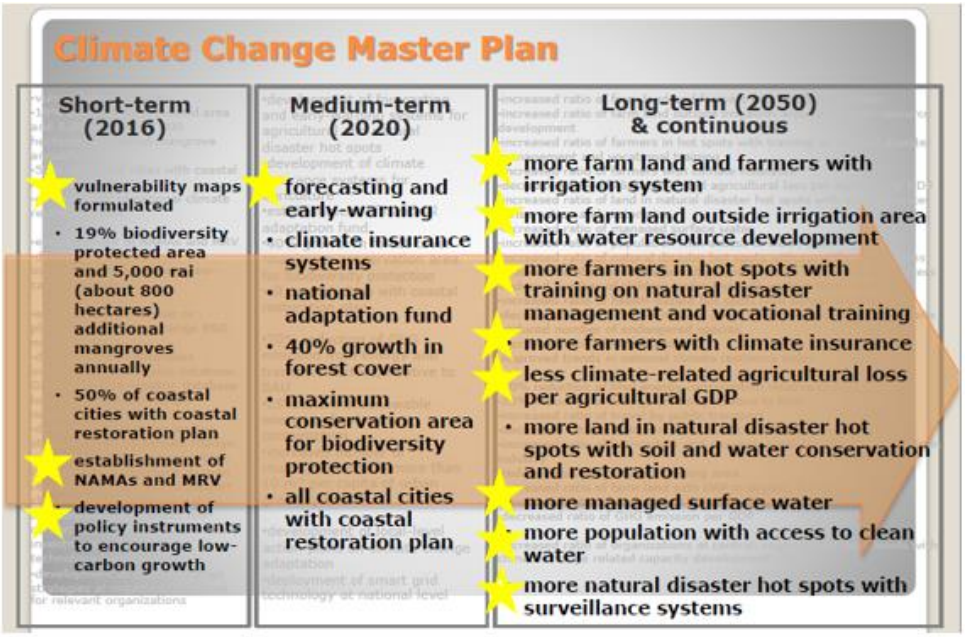
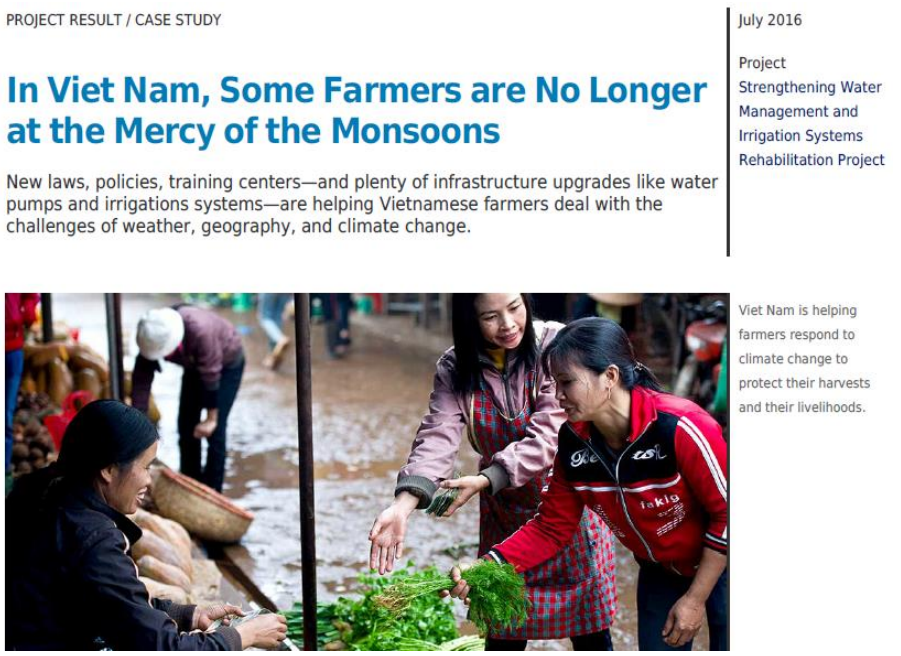


*Figure 15: Alignment of the AF project to **Thailand's Short. Medium and Long-term objectives of the Climate Change Master Plan**. The yellow stars mark the partial objectives on which the AF project will have an impact.*

For Vietnam we also refer to the national CCA agenda under its main proponent, MONRE, viz. **National Strategy on Climate Change**, period 2011-2020, (issued by Prime Minister Nguyen Tan Dung, 139/QĐ-TTg, December, 2011),
http://www.chinhphu.vn/portal/page/portal/English/strategies/strategiesdetails?categoryId=30&articleId=10051283

Its main policy objectives include prioritization of integrated water resources management to meet water needs on river basin level. Furthermore, the project closely aligns with strategic national development objectives as also supported by Vietnam's international development partners like ADB and the World Bank and for instance documented in ADB's **Environment and Climate Change Assessment for Vietnam (2013)**
http://www.adb.org/sites/default/files/institutional-document/33916/files/viet-nam-environment-climate-change.pdf

Further alignment with Vietnam's national policies and sectoral needs is documented in recent documentation on ADB's work in Vietnam.


PROJECT RESULT / CASE STUDY

July 2016

Project Strengthening Water Management and Irrigation Systems Rehabilitation Project

In Viet Nam, Some Farmers are No Longer at the Mercy of the Monsoons

New laws, policies, training centers—and plenty of infrastructure upgrades like water pumps and irrigations systems—are helping Vietnamese farmers deal with the challenges of weather, geography, and climate change.

Viet Nam is helping farmers respond to climate change to protect their harvests and their livelihoods.

In Cambodia the Cambodia Climate Change Strategic Plan (CCCSP), 2014-2023 (2013; *http://www.moe.gov.kh/userfiles/image/download/1445160472781.pdf*) has laid the foundation for integration of climate change and climate resilience issues into national and sub-national level planning. The development of climate change strategies, action plans and financing frameworks are among the priority actions undertaken as defined in the National Strategic Development Plan Update (NSDP) 2009 – 2013. The development of the CCCSP was a significant step towards embedding climate change in the NSDP 2014 – 2018 and in sector development plans of all relevant ministries. The CCCSP will guide national entities and assist non-governmental organizations and development partners in developing concrete and appropriate measures and actions related to adaptation and greenhouse gas mitigation, which were the supportive pillars for the achievement of the Rectangular Strategy and Cambodia Millennium Development Goals.

This project, within its modest operational domain covering availability of water resources and sustainable use of strategic GW potential, will support these initiatives. Furthermore, it will connect directly to most of the eight strategic objectives of the CCCSP, as summarized in Table 6. The implementation schedule of this project will generate results that will directly feed into the medium-term implementation of the CCCSP, and further support its long-term (2021-2050) ambitions, in particular contributing to the following stated response measures:

- Poverty alleviation; as more than 80% of the population depends largely on subsistence agriculture, floods and droughts could push large numbers of people below the poverty line;
- Management of water and fisheries is the lifeline of the Cambodian people. Changes in hydrology as a result of climate change may have adverse effects on water resources and fisheries;
- Expansion of capacity for provision of water and sanitation, particularly to rural areas.

*Table 6: Eight strategic objectives of **Cambodia Climate Change Strategic Plan**, 2014 – 2023 and alignment with this proposal.*

Eight strategic objectives of Cambodia Climate Change Strategic Plan, 2014 – 2023		**Connection with this AF proposal (+ = weak, +++ = strong**	**Potential Impact of this proposal to the strategic objective**
1	Promote climate resilience through improving food, water and energy security;	++	+++ : food, water security
2	Reduce sectoral, regional, gender vulnerability and health risks to climate change impacts	+	+ : working with low-income groups, water supply for domestic use
3	Ensure climate resilience of critical ecosystems (Tonle Sap Lake, Mekong River, coastal ecosystems, highlands, etc.), biodiversity, protected areas and cultural heritage sites;	++	++: sustainable management of GW in the pilot areas
4	Promote low-carbon planning and technologies to support sustainable development;	-	-
5	Improve capacities, knowledge and awareness for climate change responses;	++	+++: strong knowledge and capacity building impact, awareness and climate resilience measures
6	Promote adaptive social protection and participatory approaches in reducing loss and damage due to climate change;	+++	+++: working in 2 pilot areas, participatory approaches and climate resilience measures
7	Strengthen institutions and coordination frameworks for national climate change responses; and	+++	+++: Transfer of pilot area and regional experiences to institutions and coordinated efforts

8	Strengthen collaboration and active participation in regional and global climate change processes.	+++	+++: transboundary collaboration and dissemination of results, international TA support.

For Myanmar, the project connects to the five thematic areas from the **National Adaptation Programme of Action (NAPA),** namely (1) agriculture and forestry, (2) biodiversity, (3) water resources, (4) energy, transport and industry and (5) public health. Specifically, our project will support the stated need to *"climate-proof rural water management, safeguard agricultural output from flooding and drought, combat erosion, and rehabilitate degraded lands".*

In addition, the project is aligned with the National Sustainable Development Strategy (NSDS) (NCEA, 2009) which aims to achieve sustainable management of natural resources, integrated economic development, and sustainable social development. The NSDS proposes a number of actions that would improve the resilience of people vulnerable to climate change including increasing water availability by harnessing seasonal water flows and improving storage capacity and improved water application techniques at the farm level. In our project we will specifically develop the potential to use GW and develop underground storage to provide for dry season water needs. Our approach to develop a more water-user oriented GW management practice is also in line with Myanmar's National Action Plan (NAP) under the UN Convention to Combat Desertification (UNCCD) that states the ambitions to develop more sustainable environmental management "with full participation of the local people in order to achieve indirect benefit for their present and future generations", "increase seasonal income" and "transfer the technologies to the farmers". Specifically, it will help Myanmar to:

- Integrate the principles of sustainable development into country policies and programmes and reverse the loss of environmental resources;
- Reduce the proportion of the population without sustainable access to safe drinking water and basic sanitation.

Institutionalization

Our strategy focuses on strengthening the capabilities and potential within the extended GW community to support CCA. The focus of the initiative will be on the national agencies and their networks (associated government entities and other ministries, the national policy level), and towards local managers and GW users in different sectors (local to provincial; farmers and industry, water users). We aim for important institutionalization gains at 1) the higher policy levels ("Improved GW management is an important climate resilience tool)" and 2) at grassroots, end-user level, capabilities are embedded to use GW as a resilience enhancing strategy.

F. Compliance with relevant standards and with ESP of Adaptation Fund

Part 1: Describe how the project / programme meets relevant national technical standards, where applicable, such as standards for environmental assessment, building codes, etc., and Part 2: Compliance with the Environmental and Social Policy of the Adaptation Fund (see also guidelines document AF).

Compliance with relevant standards at country and regional level

The implementation of the project at country and regional level will rely on approval from and fall under responsibility of the respective line ministries and possibly international agreements related to natural resources and GW management. It is believed there are only very few specific arrangements for technical standards on a (GMS) regional level relating specifically to GW resources and/or management. (An example is for instance international WHO guidelines on arsenic content in GW for domestic use). Besides, even though there is some regional coordination and applicable standards, mostly still national regulations and standards will prevail.

At country level it concerns natural resources management policy level issues (GW related, if these exist) and GW management guidelines and technical standards. At a more technical level, the ministries will rely on their line and technical agencies, but the institutional and regulatory frameworks in the five participating countries are quite heterogeneous. In Thailand and Vietnam GW policy and management regulations are quite well developed. But a regulatory framework for GW is virtually absent in Lao PDR, Cambodia and Myanmar. One can think of the following:

- General ownership laws on water and underground resources (with GW sometimes classified as a "mineral" resource)
- Restrictions on GW extraction and depletion, construction of drilled wells, etc.
- Guidelines and/or restrictions on GW recharge (viz. quality and pollution controls)
- IWRM guidelines applied in river basis, and sometimes including guidelines concerning the relationship between surface- and GW (issues like natural recharge, base flow, springs, etc.).
- Regulations concerning water quality protection and pollution control; application of pesticides and fertilizers may pose serious threats to GW.

It must be stressed however, that the indication "technical standards" for these regulations and guidelines is a bit undue. Technical guidelines exist but these are fairly general in nature, often not quantitatively defined, and observance of these guidelines is overall weak or non-existent. By virtue of 1) its regional approach, and 2) the focus on sustainable and responsible GW management, this project will strengthen and widen the availability and application of technical standards and guidelines, be it at a modest level.

Under these conditions, all project activities and outputs will comply with the prevailing policy, laws and technical standards at country level, firstly policy and legal, and secondly technical. The project will work within these institutional, policy, legal and technical frameworks, and with the relevant institutions. Through the project construct, ownership rests firmly within the five participating countries, but the project will support and actively seek validation against relevant regulations and standards. This may also imply preparing and introducing, in an advisory modus, new guidelines or technical standards, as in some countries or particular subjects these do not yet exist. Compliance, support and general application will the overall aim. (But the preparation and introduction of detailed and technically specified GW management regulations is not the main aim of the project; this should come when sustainable and comprehensive GW management has proven its worthas a climate resilience strengthening option.). Hence, the accent will be on collaborating with the national partner agencies, transferring expertise and capacity strengthening, also concerning the applicable technical standards.

Table 7 on the following page gives an overview of the relevant country ministries and technical agencies and departments from which relevant standards and guidelines will be used, and from which compliance will be obtained.

For capacity building and training, the project will work with the regional hubs for education and training. i.e., the leading national institutions as summarized below. The project's capacity building, training and knowledge transfer activities will be reviewed and endorsed by these institutions.

	Countries: Ministries (Policy level)	Country Agencies / Departments (Technical)	Educational / Capacity building
	Cambodia Water Resources and Meteorology; Mines and Energy; Agriculture, Forestry and Fisheries; Rural Development	**Cambodia** Department of Geology; Climate Change Department	**Cambodia** Royal University of Phnom Penh; Institute of Technology of Cambodia
	Lao PDR Natural Resources and Environment; Energy and Mines	**Lao PDR** Division for GW Management (DGM); Natural Resources and Environment Institute (NREI)	**Lao PDR** National University of Laos, Faculty of Water Resources
	Myanmar Agriculture and Irrigation Water Resources; Public Works	Myanmar Water Resources Utilization Department	**Myanmar** Yangon Technical University
	Thailand Natural Resources and Environment	**Thailand** Department of GW Resources (DGR) GW Research Centre	**Thailand** GW Research Centre, Khon Kaen University
	Vietnam Natural Resources and Environment Agriculture and Rural Development	**Vietnam** National Center for Water Resources Planning and Investigation (NAWAPI) , DWRPIS (Ho Chi Minh City)	**Vietnam** Hanoi University Water Resources; Vietnam National University - HCMC

Table 7: Overview of the relevant country ministries and technical agencies and departments from which relevant standards and guidelines will be used, and from which compliance will be obtained.

At the technical level design, implementation and monitoring of project activities has and will involve technical GW agencies from the five participating countries and/or their local/provincial representatives in the four proposed pilot areas to ensure that project outputs meet relevant national technical standards in terms of design and execution. Project component activities and outputs will meet the technical standards commonly prevailing in water and natural resources management.

For Myanmar, UN-Habitat has developed a manual on drought prevention with consultation of experts from government ministries, UN agencies, INGOs and NGOs. This manual, that certainly has relevance for the Myanmar Dry Zone pilot, will be followed as much as possible in the other pilot areas as well.

The challenge is not so much meeting the prevailing GW and natural resources management standards and regulations, as in Lao PDR. Myanmar and Cambodia these are fairly general, or in several instances, not at all or poorly defined. The challenge will be much more first to develop practices and useful interventions for which subsequently and if proven useful, regulatory guidelines and standards have to be formulated and adopted by higher policy levels. This will be done in close collaboration with the project's stakeholders and national participating agencies (Table 7).

Also here the regional cooperation aspect of this project will provide guidance, as in Thailand and Vietnam regulations are more developed and application has penetrated further. Hence, the project will mobilize and use expertise from the more advanced GW management and extension centres in the region to ensure that relevant standards and guidelines are shared and applied in a similar way across the region. Both UNESCO and CCOP-TS can make us of a rich and diversified experience in other countries from which best-practices and relevant track record can be obtained.

Compliance with ESP of AF

As a specialized agency of the UN, and in line with its Constitution, UNESCO acts with States and societies to strengthen the foundations for lasting peace, the eradication of poverty, sustainable development and intercultural dialogue. The ESP of UNESCO states that UNESCO is committed "to further universal respect for justice, for the rule of law and for the human rights and fundamental freedoms, which are affirmed for the peoples of the world, without distinction of race, sex, culture, language, religion or sexual orientation." The projects/programmes implemented by UNESCO shall be designed to meet the environmental and social principles, including *Compliance with the Law, Marginalized and Vulnerable Groups, Human Rights, Gender Equality an Women's Empowerment, Core Labour Right and Working Condition, Indigenous People, Protection of Natural Habitats, Conservation of Biological Diversity and Sustainable Management of Living, Natural Resources, Land and Soil Conservation, Land Acquisition and Involuntary Resettlement, Climate Change, Pollution Prevention and Resource Efficiency, Public Health, Safety and Security, Pest Management and Physical and Cultural Heritage*[13].

Consequently, **UNESCO is firmly committed to abide by the internationally set environmental and social policies and standards, in line with the AF** that in furthering the Fund's mission of addressing the adverse impacts of and risks posed by climate change, projects and programmes supported by the Fund do not result in unnecessary environmental and social harms.

[13] Statement on UNESCO's Environmental and Social Policies (2016), http://en.unesco.org/sites/default/files/statement_on_unesco.pdf.

G. Duplication of other initiatives or ongoing projects

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

The project is the result of an intensive regional consultation process, described under Section J (below) with participation of representatives from the five countries and international experts active in the region. The GW community is not too large, but the network includes experts with different affiliations (government organisations (different ministries, such as natural resources, agriculture, water, environment and climate change policy), R&D institutions, universities, etc.). In this setting there is a good oversight of comparable or related initiatives. There are national or more localized projects, targeting small and specific stakeholder groups, but to our knowledge there is no existing or planned regional and multifaceted programmes as described in this proposal and thus currently no potentially overlapping initiatives.

Earlier initiatives with a somewhat comparable focus included a launch workshop in 2011 by the Asia Pacific Water Forum (APWF) for a regional knowledge hub for GW management, with support of the Institute for Global Environmental Strategies (IGES, Japan), ADB, Department of Groundwater Resources (DGR), Thailand Asian Institute of Technology (AIT), and other knowledge hub partners (see: http://www.iges.or.jp/en/natural-resource/GW/knowledgehub_gw_20110602.html. The meeting had three main objectives:

- Discuss and explore ways to highlight and prioritize GW issues on main water agenda and identify feasible actions for sustainable development of resources;
- Clarify importance of GW in the time of global change to address food and water security and suggest ways to safeguard its strategic resource value from emerging challenges;
- Facilitate partnership with clients, partners and relevant organisation working in the field of GW and dig into opportunities to synergize efforts being taken in different corners of the region.

But this project lacked concrete interventions on the ground due to poor financial support and after the launch workshop there was no further follow-up.

A more successful example of a past initiative is TWAP http://twapviewer.un-igrac.org. This is now being set up as an independent project and is financially supported, but has no explicit Mekong Region focus.

About TWAP

Recognizing the value of transboundary water systems and the fact that many of them continue to be degraded and managed in fragmented ways, the Global Environment Facility Transboundary Water Assessment Programme (GEF TWAP) was developed. The Programme aims to provide a baseline assessment that identifies and evaluates changes in these water systems caused by human activities and natural processes, and the consequences such have on dependent human populations. The project is the first truly global comparative assessment for transboundary aquifers, lakes, rivers and large marine ecosystems, as well as a thematic evaluation of the open ocean, through institutional partnerships that hope to seed future global assessments. The project results are envisioned to assist the GEF and other international organizations in setting priorities for supporting the conservation of transboundary water systems. More information on TWAP including final reports can be found on www.geftwap.org

The portal gives access to the map based results from the GW component of the Transboundary Waters Assessment Programme. The data shown in this portal have been made available by national experts from countries involved in the TWAP GW project. It also includes the results from scenario analyses using the global WaterGAP model (University of Frankfurt, Germany) and a study on GW systems of small island developing states, also called SIDS (Simon Frasier University, Canada). More information on TWAP GW, including reports on methodology and outcomes, can be found on www.twap.isarm.org

H. Learning and knowledge management

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

Learning and knowledge management is one of the key components of the project (under Component 5); capacity building, training and knowledge dissemination are firstly directed at the CoP of GW workers, who need to be better equipped with proper management tools and supported with relevant expertise, and secondly, at GW end-users and stakeholders who need to be more aware and supported with technologies and information to use GW to increase resilience. Hence, the learning and knowledge development and management outcomes for the project have been defined as:

''Internal capacity in the GMS to develop CCA policy and practical resilience enhancing interventions, to use state-of-the-art tools and work with CoP, stakeholders and vulnerable groups ''

The proposed regional approach will ensure involvement and results for five countries and operational and resource efficiency. Activities to capture and disseminate lessons learned include (see also under Component 5, Part II, Section A):

- A series of training workshops with participants from the GW CoP from the five countries
- Dissemination of relevant expertise and skills to end-users in resilience pilots. In these practical, hands-on demonstrations we will exploit various learning tools, such as: news items in local media, public and school presentations, water management briefings with local community groups, awareness actions for private sector, short training workshops and courses on climate change. Information and supporting guidelines will be consolidated in policy briefs for national decision makers, best practice guidance materials and tools.
- Collaboration with the training institutes in the countries to adapt and improve formal training programmes and promote increased participation by women in the sector.
- Setting up of a knowledge management repository and exchange facility (Sharepoint)
- International conference

A more detailed work plan for the proposed activities will be developed during the Inception Phase of the project.

The first challenge of the learning and knowledge management component of the project is to address a number of knowledge and information gaps; it is of critical importance that knowledge and learning development starts from the correct foundations and proper understanding. The following are important and basic resource management concepts that need to be addressed: (between brackets the project component/activity in which the issue will be addressed):

- Extent and/or characteristics of superficial and confined aquifer systems, including resource volumes in aquifers systems in the selected pilot areas, existing and/or potential water quality threats (Component 1).
- Current GW volumes being abstracted for various uses; future demand scenarios for irrigation, urban and rural water supply (Component 2)
- Relationships between recharge in highland areas and resource potential in lowland areas. This includes several important transboundary systems. Climate change and land use changes will affect these delicate balances in supply and demand (Component 1).
- Sustainability (in view of increasing abstraction) and vulnerability of riparian GW resources to climate change induced changes in precipitation and changes in river flow regimes, be they natural or anthropogenic (Component 1).
- To understand better the resource and resilience potentials and vulnerabilities of GW systems of the region, detailed hydrogeological and geophysical investigations are required. A crucial monitoring network is needed to monitor resource status and critical depletion, and for developing and using regional GW information systems and GW flow models. These regional (transboundary) GW models and information tools will help manage resources. It is therefore also needed to visualize (in maps) regional and transboundary GW (recharge and extraction) systems and enable assessment of GW recharge rates from flooding and rainfall under the current and future climate conditions. (Component 3).
- Determine GW resource potential in shallow and deep aquifer systems (for different users) and demonstrate how this potential can be developed to increase resilience. (Components 1, 2 and 3).

Learning, knowledge development and sharing of expertise are key elements of the program; the more advanced groups (Thailand, Vietnam) will contribute to this process by helping their less advanced colleagues in Lao PDR, Myanmar and Cambodia. In comparison with isolated single-country interventions this is much more cost effective. The bulk of the technical support work can be done by regional experts.

Capacity building to form a regional community of experts and address societal needs: Sustainability aspects are highly dependent on the human resources capacity dimensions. With a strong focus on human resources development a new generation of better skilled and equipped GW experts will engage with pertinent challenges of the coming decades. They can do this better in a concerted manner, with common tools and data. Sustainability is also enhanced by closely linking GW resource studies to societal needs (in various sectors like food production, domestic water supply, industry, ecology/environment). A regional CoP will be fostered, building upon efforts previously undertaken by the project partners. This CoP will meet and share issues annually. The project will also provide an enabling environment and give support to postgraduate studies. The opportunities for regional cooperation are being greatly strengthened in readiness for the establishment of the ASEAN Economic Community later this year.

Finally, the project will benefit for proposed project partners' (IWMI and IGRAC) dedication to knowledge development and sharing, such as IWMI's global GRIPP initiative. GRIPP would provide a useful vehicle for knowledge sharing at the regional and global levels.

GRIPP: Groundwater Solutions for Policy and Practice

GRIPP is a global level, multi-partner initiative of the IWMI working closely with IGRAC and a host of other partners. Its aims are to '*secure GW resources for livelihoods, food security, climate resilience and economic growth while sustaining the resource for future generations*' by:

a) creating long-term partnerships
b) sharing lessons
c) scaling-up successes
d) filling knowledge gaps

Thus GRIPP brings in tested success stories, new technology, and innovative policy and institutional approaches for GW management in order to achieve the SDGs related to climate resilience, food security, and sustainable water management. As this global mandate conform closely with those of this regional project, it is anticipated that the inception phase of this project will enable close interactions and linkages to be developed to enable two-way feedback and learnings to better address these contemporary GW management challenges.

For further information visit: http://gripp.iwmi.org/

GRIPP

GROUNDWATER SOLUTIONS FOR POLICY & PRACTICE

I. Project consultation process

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

The consultation process for the preparation of the AF project proposal has been guided by UNESCO and CCOP-TS with external support of IWMI and IGRAC, in close contact with national partners in the five countries. Crucial element in this process has been the possibility to obtain first-hand information, experience and input from local stakeholders through earlier and ongoing work in the five countries. This proposal is largely the result of this ongoing presence in the region and the approach underwrites the long-term engagement with the subject and, increasingly, also the awareness on significant vulnerabilities. Although the engagement of CCOP-TS and UNESCO with the GW CoP has been successful in its own right, the need was felt to raise the stakes and bring the challenge of CCA and supporting resilience to the forefront. Hence, this is one of the objectives of this AF project. In these project preparation workshops (listed below) also discussions were dedicated to the challenge of how to interact with stakeholders in such a way that vulnerable groups and women are prioritised. Consensus was made by all participants that girls and women in unsafe/polluted environment of GMS suffer from lack of fresh water access, sanitation problems and increasing vulnerability to water-related disasters. Special emphasis should be placed on sustainable GW supply to the rural poor, women in the vulnerable working environment and girls in unsafe conditions through continuous consultation and close collaboration with local community/NGOs/governmental bodies. In the characterization of the four proposed pilot areas (Annexed) further supporting information is provided as to the role of potential beneficiaries, vulnerable groups and GW users.

A summary of relevant activities of the international consultation process is provided in the table below:

Consultation	Date/Place	Participants	Objective
Vietnam, Mekong Delta Participation in research workshop of Rise & Fall research on GW and land subsidence in Mekong Delta (https://www.uu.nl/en/futuredeltas/project-rise-and-fall	March 2015, Can Tho, Vietnam	National and regional experts, international researchers, representatives from regional government agencies Mekong Delta	Dissemination of approach for and results of GW studies and climate adaptation approach, data collection, discussion on GW management in the delta provinces.
Consultations with village authority and households on community managed water supply for domestic use and agriculture.	April-September 2015; Ekxang village, Phonhong District, Lao PDR	Households comprised of ethnic minority groups, household heads, village authorities	Discussions to establish how communities self-manage GW supplies to reduce vulnerability to extreme seasonal water scarcity.
CCOP-KIGAM-UNESCO-DGR workshop on Sustainable GW Management in Mekong River Basin	May 2015, Bangkok, Thailand.	KIGAM, CCOP-TS, DGR (GW Agency) staff, international and national experts, representatives of regional stakeholder groups	Discussions on regional cooperation for GW management, effects of climate change; Status reports on GW management practices in the countries; Discussions on the project concept.
Multiple meetings and workshops on development of Lao PDR GW policy, management and capacity development	April-September 2015, Vientiane, Lao PDR	MONRE officials Lao PDR, national GW experts, provincial officials and community representatives	Discussions on development of Lao PDR National GW Action Plan, Climate Adaptation & resilience measures; Discussions on the project concept.
Meetings on regional cooperation GW management	September 2015, Bangkok and Khon Kaen, Thailand	CCOP-TS, DGR (GW Agency) staff, experts of AIT, Chulalongkorn University, GW Research Centre Khon Kaen University	Discussion on technical issues (GW monitoring, data collection capacity development and regional cooperation).
Village consultations under Myanmar Healthy Rivers Initiative (IWMI)	November 2015 – ongoing; Six villages in Myanmar	Villagers (farmers and fishermen) and community representatives (including women's groups), local government officials	Ongoing project on water use and access in rural villages, and community priorities and concerns (with specific consideration of issues of women and the poor); includes consideration of use of surface vs GW resources.
Regional workshop on GW management BGR-NAWAPI	January 2016, Can Tho, Mekong Delta, Vietnam	National GW experts, provincial officials and community representatives; farmers groups and village people	Sharing experiences and practices on GW management, climate adaptation and resilience, discussions on the project concept
UNESCO-IGRAC workshop GW Monitoring Workshop for South-East Asia;	March 2016, Bangkok Thailand.	National GW and hydro met experts, provincial officials and community representatives;	Discussion on the technical project activities (monitoring, data collection and management), Capacity development and regional cooperation

CCOP-KIGAM training workshop on sustainable GW resource management with partner agencies from the Mekong region.	May 2016, Daejeon, Korea	National GW experts from Mekong region countries, provincial officials and national GW researchers in Mekong region	Discussions on GW status in each country and training on prediction and management of GW security.
CCOP-KIGAM-UNESCO-MME Workshop on "Climate Change and GW Resources in the Mekong River Basin".	June 2016, Sihanoukville, Cambodia	National GW experts, provincial officials and community representatives; community representatives	Proposal preparation of this proposal, with representatives of all partners from the region
Farmer Consultation on Community scale GW irrigation	August 2016 Phousan village, Phonhong District, Lao PDR	Women and men farmers, agricultural extension officers, district officials	Consultation with farmers and other stakeholder on the viability of community scale GW irrigation based in initial results of a pilot trial
ACIAR-MAF Policy Dialogue	October 2016 Vientiane, Lao PDR	Vice Minister, Department Heads, government officials, researchers	Policy-science discussions on the potential role of GW-for-irrigation for small for agriculture in Lao PDR
UNESCO-IGRAC workshop on Monitoring for Regional and Transboundary GW Management for Vietnam	October 2016 Hanoi, Vietnam	National GW experts, provincial officials and international GW specialists	Discussion on the technical project activities (monitoring, data collection and management), Capacity development and regional cooperation
IWMI – MOALI workshop on GW in Myanmar Dry Zone	November 2016, Napyitaw, Myanmar	National GW experts, Ministry officials, international GW specialists	Discussion on availability and access to hydrogeological data in Myanmar, and Ministry priorities for GW resource assessments.
Participation in workshop of SALINPROVE project on Mitigating GW SALINity impacts for imPROVEd water and food security in coastal areas under socio-economic and climate change	28 November – 2 December, 2016 Tra Vinh , Viet Nam	National and regional experts, international researchers representatives from provincial government agencies Tra Vinh, Mekong Delta, Vietnam.	Discuss the overall outcomes of the project, the activities and work plan for 2016/2017, the involvement of the stakeholders, and the data requirements and acquisition strategy.
Participation in workshop of Project on Adaptation to GW vulnerability of Asian cities to climate change: developing capacity to bridge the science and policy interface.	Asian Institute of Technology (AIT), Thailand 13-14 December, 2016	National experts from Thailand, Vietnam, Pakistan, and Indonesia; international researchers from Asian Institute of Technology (AIT), Institute for Global Environmental Strategies (IGES)	Shared a draft of methodology of GW vulnerability assessment and adaptation options and its application; Presented the overall status of GW resources in their respective cities and then prioritize major issues; Prioritized the GW vulnerability issues and indicators using multi-criteria decision-making and identify suitable set of indicators for vulnerability assessment, and finally prioritized potential adaptation measures.
Consultations and meetings on the use of GW for water supply in Lao provinces	Late 2016 and ongoing, Lao PDR	ADB, Lao PDR national GW experts, officials Ministry Public Works, Dept. Water Supply, provincial officials and community representatives (water supply sector);	Sustainable and responsible use of GW, resilience measures, capacity development, monitoring and data collection

UNESCO coordination and consensus building role builds on established experience in diverse programmes on environment and natural resources management, both in and beyond the region. UNESCO, through its diplomatic and official network, has access to, and is able to mobilise high-level political and institutional offices and support in the region. In this way, UNESCO was able to muster support for this proposal and this will be the way UNESCO will support during implementation. On the one hand disseminating information on the project status, objectives and progress, and on the other hand seeking for confirmed political support, assistance (if needed) and promoting acceptance and embedding of verified project results.

CCOP-TS executive support: The CCOP-TS approach is such that progressively regional collaboration takes place without much external technical assistance; CCOP-TS has nearly 60 years of experience with keeping regional cooperative networks alive in this way.

In preparation of the proposal, important support was also gathered in the following consultative meetings:

1. CCOP-KIGAM-UNESCO-DGR Workshop on Sustainable Groundwater Management in Mekong River Basin 19-20 May 2015, Bangkok, Thailand.

CCOP Technical Secretariat, in collaboration with the Korea Institute of Geoscience and Mineral Resources (KIGAM), the UNESCO Bangkok Office and the Department of Groundwater Resources (DGR) of Thailand, co-organized this workshop on 19-20 May 2015 in Bangkok, Thailand. This meeting is within the framework of the five-year CCOP-KIGAM Project "Solutions for Groundwater problems in the CCOP region" funded by KIGAM since 2013.

The meeting was attended by 26 participants (45 % female) from CCOP Member Countries, Cambodia, Republic of Korea, Lao PDR, Myanmar, Thailand, Vietnam, international resource persons and CCOP-TS staff.

It was recognized from the presentation of country reports that Cambodia, Lao PDR and Myanmar have limited information available on GW resources and lack any mechanisms to regularly monitor GW for quality or quantity. On the other hand, Thailand and Viet Nam have adequate monitoring data at the national level. To address this dearth of information on GW and encourage collaboration in its management, a proposal was made during the workshop for the creation of a GW monitoring network and to provide technical support to countries in need of developing sustainable management plans for this resource.

Figure 16: Participants of the May 2015 workshop (not all shown in the picture)

2. UNESCO-IGRAC workshop, Bangkok, March 2016

UNESCO-IGRAC workshop Groundwater Monitoring Workshop for South-East Asia; On 15-16 March 2016, the workshop was held in Bangkok Thailand. The workshop was organised by UNESCO Bangkok Office, DGR and the IGRAC under the framework of the Global Groundwater Monitoring Network (GGMN) programme. In total 45 GW specialists from six countries (Cambodia, Iran, Malaysia, Myanmar, Thailand and Vietnam) attended the workshop.

Workshop objectives
The purpose of the workshop was to bring together national and international GW experts to review the state of GW monitoring in the region, to introduce the GGMN programme and its possible role in Southeast Asia. The workshop was also intended to build synergies and strengthen international water cooperation.

Results and Contributions
Presentations were given by country representatives to share experiences on the current state of GW monitoring, information management and future challenges. The GGMN was introduced followed by a live demonstration of the GGMN Portal. Participants explored the functionalities of the GGMN Portal to become familiar with the GGMN Programme and the GGMN Portal functionalities. There was an interactive session to identify the bottlenecks for proper GW monitoring and translate some of those into additional developments for the GGMN Programme.

Professor Yangxiao Zhou (IHE Delft Institute for Water Education) provided a presentation on GW monitoring in the Netherlands and the use and application of time series analysis for GW monitoring data. Afterwards, participants learned how to work with the time series analysis tool available in the GGMN Portal and how to create spatially interpolated GW maps using the GGMN Portal. Sangam Shrestha (Asian Institute of Technology) presented the recently published book: 'Groundwater Environment in Asian Cities: Concepts, Methods and Case Studies'. Wytze Schuurmans and Nienke Ansems introduced the use of remotely sensed data for monitoring and the role of information technology and big data in GW research and management.

3. CCOP-KIGAM workshop Sihanoukville, Cambodia, June 2016

A workshop on *"Climate Change and Groundwater Resources in the Mekong River Basin"* was convened in preparation of this proposal, with representatives of all partners from the region (Sihanoukville, Cambodia, 1-4 June 2016.

CCOP-KIGAM-UNESCO-MME Workshop
"Climate Change and Groundwater Resources in the Mekong River Basin"

Date: 1-4 June 2016
Venue: Sihanoukville, Cambodia
Host: CCOP, KIGAM, UNESCO, and MME
Participants: Vietnam, Lao PDR, Cambodia, Thailand, Myanmar, China, Republic of Korea and international experts

Background
GW is a valuable natural resource and one of the primary sources of water in Mekong River countries. Global climate change is expected to affect availability and sustainability of GW resources by altering hydrological cycles and GW recharge in the face of human activities (higher demand). Despite its importance, the impact of climate change on GW resources has received inadequate attention in Mekong River countries. The communication and collaboration between countries are required (1) to more urgently assess climate change effects on GW, and (2) to mitigate the impact of climate changes to the water resource supply in the Mekong River Basin.

Aims of the workshop
The objectives of this workshop were to promote sharing information and best practices among Mekong countries for assessing availability of GW resources under climate change and to support member countries to prepare for sustainable GW management. The key players of each country in the Mekong River Basin addressed major issues and status of GW management with changing environment. Strategies to enhance collaboration between neighbouring countries and to adapt to future climate change were discussed. The workshop provided opportunities to further understand the dynamic relationships between climate change and GW and to provide strategies for sustainable GW resource management in the lower Mekong River Basin.

In all, the sequence of regional meetings and workshops laid the foundation for the project concept and consensus on priorities and opportunities. The meetings were well attended by a regionally representative assemblage of GW experts, policy-makers and government officials responsible for natural resources management and CCA policies. The network has multiple important functions:

1. Share ideas and information on the status of GW resources management and alignment with national and regional government policies
2. Provide an opportunity to assess the status of national capabilities and mandates
3. Support regional cooperation, capacity building and knowledge exchange. The regional network is complemented and supported by international experts.
4. Identify opportunities and priorities for regional cooperation and increasing the impact of the sector.

It is believed that the series of workshop and bilateral meetings has resulted in a shared vision and ambition to use GW expertise and potential not just as an additional natural resource, but as a strategic asset, that, when used sustainably and responsibly, can make a significant contribution to climate resilience and livelihood improvement.

Until this stage, vulnerable groups and GW users in the five countries and proposed pilot areas have been involved indirectly in the proposal consultation process. The process of consultation will continue during the Inception of the project, and during project implementation, with direct consultations between the project team and national implementers and stakeholders in the pilot areas.

Because of the open and participatory nature of the mentioned consultation workshops (and characteristic for the approach of CCOP-TS and UNESCO in their programmes) the consultation and technical discussions are fruitful in bringing to the fore specific and/or new concerns from country representatives. As a result, this proposal incorporates and prioritizes some of those concerns, in particular **the engagement of GW experts and the GW CoP directly with stakeholders and GW users**. This approach is now much more at the core of the project. (Traditionally and very often discussions in GW expert group workshops, conferences, etc. deal with very specific technical and details and the workings of the physical GW system, and not so much with the interests of vulnerable groups). Primarily, in the consultation process, participants from the region, with firm connections to the "local" issues and GW users in the provinces, were able to specifically present their views and experiences. So, with participating international experts who work in the region, and GW workers from the five countries attending there was a strong link from GW users and vulnerable groups and their concerns to project conceptualization.

- (Inter)national experts and GW workers from the region involved in proposal preparation are actively working on the ground and have a strong link with GW users and stakeholder groups in the countries and in the proposed pilot areas
- Issues discussed and inserted into the project concept primarily reflect concerns of user groups and stakeholders, although these groups and their interests will be more specifically framed during project implementation, when we will bring on board experts in gender analysis and on regional indigenous communities.

J. Justification of funding

The project focuses on building climate resilience on the basis of “hidden” and poorly managed GW resources in particular for vulnerable rural communities, and other low-income users in cross-border regions of Lao PDR, Cambodia, Thailand, Myanmar and Vietnam.
The overall justification of the project lies in the potential to use GW, always a reliable and “safe” resource for low-income groups to provide water for food production, domestic use and production processes. This potential remains undeveloped in large parts of the GMS for a number of reasons. The project will address the following:

- Poor information on and confirmation of resource potential: The project will prepare an updated GW inventory of shared aquifers in border regions (four pilot areas), develop resource management concepts and tools, and set up a much needed monitoring network for GW systems.
- Regional collaboration will enhance understanding of GW recharge processes and formulate recommendations for protection and long-term sustainable management.
- In the general approach and in the pilot areas issues of transboundary GW management will be addressed. Taking up transboundary challenges will also form an incentive to develop collaborative solutions.
- In addition to making use of the available national capacities, the project will aim for intensive participation of local stakeholders by implementing principles of GW governance through 1) dialogues with users to assess GW use scenarios for different sectors (agriculture, industry, rural and urban domestic water supply) and 2) develop and provide appropriate information to ensure sustainable use by different user groups (agriculture, industry, domestic water supply).
- On the basis of improved information (supply/demand assessments, climate vulnerability profiles) the project will develop and implement targeted vulnerability reduction measures, GW supply quality improvement measures, and identification and protection of strategic GW reserves. Implementation of different project activities will be integrated in the four pilot areas and will generate resilience deliverables on the ground.
- On the medium and longer-term the investments in training, capacity building and raising standards for the GW CoP across the GMS and initiating regional water cooperation (diplomacy) will generate long-term benefits.
- Strategic planning for GW resources will support high level policy consensus and regional cooperation and make significant contributions to climate resilience of low income and rural population.

In the following summary, for each main project component a justification of the funding is given, followed by a concise reflection on Adaptation alternatives.

(Table on next pages)

<table>
<tr><td colspan="4">Component 1: GW resource assessment and monitoring: to obtain and use a harmonised regional GW resource inventory supporting regional GMS approach to address challenges of climate change and resilience, and enables an information-based policy to manage resources and further develop new GW-based resilience strategies and practical interventions.</td></tr>
<tr><td rowspan="5">Outcome: A regional GMS approach to address challenges of climate change and resilience is created based on an information-based policy.</td><td>Baseline (without AF)</td><td>Additional (with AF)</td><td>Justification</td></tr>
<tr><td>Governments and user groups have incomplete to severely limited knowledge of GW resources and no consistent assessment.</td><td>A comprehensive overview of regional GW resources (quality, quantity) is included in a easily accessible inventory (GIS, database).</td><td rowspan="4">It is essential to prepare a thorough inventory of available GW resources. But this should not be an academic or stand-alone investment. The resource potential should be made in close connection with a comprehensive assessment of water user needs (for different sectors: rural food production/agriculture, domestic water needs and small town water supply). Without proper understanding of the resource availability GW can still be used as a resilience (as is done in many places), but issues of sustainability and depletion of scarce resources will crop up.

By combining expertise from within the region with modest Technical Assistance support in a focused and coordinated intervention valuable and relevant resource availability information will be prepared and made available in formats that improve use by stakeholders and users. It will be possible to level regional differences

Adaptation Alternative? Information on GW resources is available especially in Thailand and Vietnam, but much less so in Myanmar, Lao PDR and Cambodia. This unbalanced information base is not supportive to sustainable resource use and developing fair and equitable resilience measures, forms a challenge especially for proper management of transboundary aquifer systems. Existing GW information lacks detail and quality due to a low level or absence of monitoring, especially so with respect to GW management in border regions. So it would be difficult to work on the basis of existing information and not possible to achieve the set objectives.</td></tr>
<tr><td>There is some GW-related info, but hardly used for this purpose.</td><td>GW information forms the basis for specific climate resilience measures.</td></tr>
<tr><td>GW seen as a static resources (basic inventories) and no to little data on temporal changes (or depletion)</td><td>Monitoring system and information operational and used for periodic updates.</td></tr>
<tr><td>Currently, GW information is hardly used.</td><td>Clear and consistent reference to GW in support of climate resilience development.</td></tr>
</table>

<table>
<tr><td colspan="4">Component 2: Priority use and Stakeholders: Stakeholders from different GW user sectors increasingly participate in decision-making on resource management issues and have access to information and guidelines that support more sustainable use region-wide.</td></tr>
<tr><td rowspan="3">Outcome 2: GW users including women from different economic sectors in the GMS have access to requisite information and guidelines and thus participate in GW management.</td><td>Baseline (without AF)</td><td>Additional (with AF)</td><td>Justification</td></tr>
<tr><td>Farmers and other users deplete GW resources regardless of CCA challenges.</td><td>Multiple users aware of and supported with resource management information and guidelines; support available in transboundary regions.</td><td rowspan="2">Due to the scientific and academic character of GW studies, also a somewhat neglected chapter not really part of water resources management and neither at the core of natural resources management, the results of GW studies were always a bit out of reach for many GW user groups. By addressing this, the project will deliver tangible results to different water users so that a) climate change resilience is strengthened, and b) limited but critical GW resources are not depleted. This will be done in close consultation with the stakeholders, in all parts of the proposed pilot areas. From the local pilots, the project will reach for higher institutional and policy levels, to ensure recognition of GW as a resource that can contribute to regional resilience.
Adaptation Alternative? Working in the traditional manner will bring the risk of not reaching the target groups, or maintaining the mismatch and poor coordination between the GW CoP and the user sectors. The project workplan allows for flexibility and adaptation (to be used during the Inception Phase) to specific require-ments to generate results in the pilot areas.</td></tr>
<tr><td>Information on GW potential is not tangible enough to motivate users to adopt and apply.</td><td>Supporting national partners dedicated to provide users (in-country and transboundary) with adequate information.</td></tr>
<tr><td colspan="4">Component 3: Resource management, information tools and equipment: will support greater resilience and more sustainable GW resource use, with protection of low income and vulnerable user groups; resource management methodology support better transboundary GW policies that are more robust and climate change ready.</td></tr>
<tr><td rowspan="3">Outcome 3: Climate resilience and GW use in pilot areas is increased, and low income and other vulnerable groups' needs are prioritized.</td><td>Baseline (without AF)</td><td>Additional (with AF)</td><td>Justification</td></tr>
<tr><td>Next to basic resource inventories (GW maps) there is no tailored information to support sustainable resource use of specific measures to support resilience.</td><td>Greater resilience and sustainable GW resource use, enabling low income and vulnerable user groups to use GW resources optimally when needed.</td><td rowspan="2">On the basis of improved information (supply/ demand assessments, climate vulnerability profiles) the project will develop and implement 1) targeted vulnerability reduction measures, if necessary aimed at meeting the needs of specific or vulnerable groups, 2)GW supply quality improvement measures,m3)identification and protection of strategic GW reserves.
Ad 1-2: For each of the pilot areas a critical analysis will be prepared of vulnerabilities for agricultural production, domestic (rural) water supply and possibly other major water users (industry like food processing). Other sectors/stakeholders are not excluded. This will clarify the main climate change related vulnerabilities and stakeholder groups. We will focus on vulnerabilities that have potential to be mitigated on the basis of improved</td></tr>
<tr><td>No transboundary cooperation, incompatible resource inventories, no communication.</td><td>Joint and coordinated efforts to use information and tools (monitoring) to develop and apply GW management</td></tr>
</table>

	Only very basic, general information is available	Comprehensive information, tools and methods developed and applied; resilience measures developed and applied (related to the physical GW system, governance of water resources or adaptation of user needs).	and responsible GW management. Such practices could include: seasonal withdrawals for specific purposes, in combination with recharge measures, adaptation of user needs (different crops or income generating activities), governance and administrative arrangements (allocate limited shallow GW for low-income users), diversification of GW based water supply (deeper aquifers, new well fields), quality treatment of surface- or GW to make it suitable for specific user needs; technical improvements of extraction wells. Increases in extraction should be accompanied by resource conservation (elsewhere) or increase in recharge. Ad 3: Vulnerability mitigation should be accompanied with a careful assessment of water needs versus water sourcing options (surface water or GW). Improved understanding of the GW system (Component 1) supports a better assessment and quantification of the available resources and possibly specific constraints in further use. Vulnerable high quality resources (i.e. for drinking water supply) may need to be protected. GW use options could be adapted (i.e. strategically located deep GW extraction cold replace vulnerable shallow extraction). Basic monitoring of GW dynamics is needed to be able to match regional extraction volumes/rates to regional recharge rates. All measures rely on support from and awareness in stakeholder/user groups, which is in itself already a vulnerability reduction result. Implementation of different project activities will be integrated in the four pilot areas and this will generate resilience deliverables on the ground. The project will provide farmers and rural communities and village water user groups in the pilot areas with awareness, understanding and skills to manage limited GW resources to overcome climate-change induced perennial droughts and water shortages. **Adaptation Alternative?** One of the fundamental questions is the use of surface vs. GW. In principle, similar resilience levels could be reached with the use of surface water, commonly available in the proposed pilot areas (but not in drought periods). However, the investments needed to ensure availability of surface water and the complexities involved in management give low-income user and rural communities poor leverage and little influence. Surface water, originating outside the area, and destined for other users downstream, is not really an alternative for the "hidden" resource underground. Our approach complements other interventions that deal with surface water management.

Component 4: Regional cooperation, coordination and information exchange will result in the development of a regionally coherent policy for CCA through sustainable GW resource management, a level playing field for GW users from all sectors throughout the region and efficiency gains through a common approach and collaborative support tools.			
Outcome 4: A regionally coherent policy for sustainable GW management in support of CCA is adopted based on a level playing field of all users in the GMS.	**Baseline (without AF)**	**Additional (with AF)**	**Justification**
	Despite common CCA challenges countries in the region do not optimally share practices, knowledge and resources	Regionally coordinated GW use contributes to regional, cross-border climate resilience for food production, rural water supply, etc.	In the provinces, when discussing GW resources for use in agriculture or for domestic purposes, few people realize the resource is not simply available from an underground (limitless) source, but forms part of a complex system with recharge areas, GW flow in complex aquifer systems, interaction with surface water and sometimes is affected by large scale spatial and long-term temporal dynamics. A similar misunderstanding is encountered among higher policy levels. Our approach for regional and transboundary, joint development is aimed at overcoming these misunderstandings. This justifies a fair amount of bilateral and five-country meetings and workshops, to create a joint understanding, both on advanced technical levels, as well as on policy coordination and complex cross-border cooperation. **Adaptation Alternative?** From a GW management perspective, there is no real alternative; if there is no real cross-border coordination resource depletion will take place in the medium- to long-term, and communities on both sides of the border will suffer.
	Vulnerable groups in the region and cross-border suffer from detrimental impact of resource depletion and increasing climate change vulnerabilities.	Collaborative transboundary approach to protect limited resources and support vulnerable groups.	
Component 5: Capacity building and training will enhance the internal capacity of the GW community of experts in the GMS region to develop and contribute to CCA policy and practical resilience enhancing interventions, to use state-of-the-art tools and work with stakeholders and vulnerable groups.			
Outcome 5: GMS stakeholders and communities capably use project tools on GW use for CCA and resilience.	**Baseline (without AF)**	**Additional (with AF)**	**Justification**
	Within the region different national groups work on rather different knowledge levels and there is little bi- or multilateral cooperation.	Community of Practice of GW experts is able to contribute to CCA policy and practical resilience enhancing interventions.	The project investments in training, capacity building and raising standards for GW CoP will use within-the-region training. There is a high (double) return on investment as both the participants as well as the host institutions will benefit. The programme will offer fertile training grounds for a new generation of experts, in a learning-by-doing approach that will cover practical, on-the-ground issues in the pilot areas, but also higher policy levels. New and innovative subject matter and policy context will be injected to give more relevance to the sector. The project will be implemented with limited international TA and build on existing networks. **Adaptation Alternative?** The direction of development is really set for further ASEAN cooperation for and coordination of important
	Although there are regional network meetings there is little coordinated effort to improve overall impact level.	Through regional cooperation GW experts have reached a higher and collaborative knowledge and impact level	
		GW CoP is regionally active and able to	

		contribute effectively to different GW system, sustainability or CCA challenges.	policies in the region. It is an option to implement the project with experts from advanced countries in the GMS region (Thailand, Vietnam). But this will lead to unsustainable results in the priority areas and for priority low income groups in Myanmar, Lao PDR and Cambodia. The underdeveloped GW management capacity in these countries is a challenge and an opportunity to develop greater climate resilience. Bringing in more international TA will substantially raise the interventions costs, as would training in leading institutions outside the region.

K. Sustainability of outcomes

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

Sustainability aspects are highly dependent on the human resources capacity dimensions. With a strong focus on human resources development in this project, a new generation of better skilled and equipped male and female GW experts will be supported to engage with pertinent challenges of the coming decades. They can do this better in a concerted manner, with common tools and data. Sustainability is also enhanced by closely linking GW resource studies to societal needs (in various sectors like food production, domestic water supply, industry, ecology/environment). A regional CoP will be fostered, building upon efforts previously undertaken by the project partners. Working in a more concerted manner, this GW CoP will meet and share issues annually. The project will also provide an enabling environment and give support to postgraduate studies; this will generate long-term benefits to the sector and enhance sustainability. The opportunities for regional cooperation are being greatly strengthened in readiness for the establishment of the ASEAN Economic Community later this year.

The proposed implementation partnership, with UNESCO (Bangkok Office), CCOP-TS as executive partner and technical support from IWMI and IGRAC will form a solid foundation for outcome sustainability. All partners have a long time presence in the region and are dedicated to continue their activities, in close cooperation with the national partners. The envisaged project cooperation will simulate stronger and more effective intraregional cooperation in the future, and provides a collaboration model that makes more effective use of support from partners outside the region (like JICA, AusAid, KOICA, BGR, global funds and other development initiatives).

Project outcomes will be shared and made available for uptake by relevant regional organisations such as MRC and Climate Change coordination focal points under ASEAN. On the national level, national Mekong River Commissions will be engaged.

L. Environmental and social impacts and risks

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

As further elaborated in project management section three, the proposed project seeks to fully align with the Adaptation Fund's Environmental and Social Policy (ESP). Table 8 (in Section III.3 below) summarizes the initial analysis that has been carried out to evaluate environmental and social impacts of the project versus the AF policy. Also, it indicates where steps will be taken and where further assessment is needed (in those domains were positive impacts are anticipated). This will be done as part of the project monitoring and evaluation effort.

Activities under Component 1 to 5 are in general all "soft" activities. According to the Adaptation Fund's Environmental and Social Policy, "Those projects/programmes with no adverse environmental or social impacts should be categorized as Category C" (Source: Adaptation Fund Environmental and Social Policy document.) No negative environmental and social impacts, whether direct, indirect or cumulative are envisaged to arrive as a result of any of the soft activities under Components 1 to 5. Despite this, however, utmost care will be taken to ensure that no detrimental environmental or social impacts can occur.

As elaborated throughout the proposal the project specifically aims to deliver positive transboundary impacts.

The miscellaneous field activities that will be formulated in detail for the implementation of the designated pilot areas need to be scrutinized more closely. Some of these may be considered 'hard' activities, and as such have the potential, without environmental and social safeguarding and mitigation measures, to have minor negative environmental and social impacts. However, in our assessment, none of the proposed activities is expected to be in Category A or B of the Adaptation Fund's impact classification. This is because this project proposes potentially 'hard' activities that are small scale and very localized, and co-managed by local communities where possible, who have a stake in avoiding negative environmental and social impacts. This means that the potential for direct impacts is small and localized, that there can be few indirect impacts. Given this, cascading or cumulative negative impacts are also unlikely.

Section 2 of the Management Part below deals with potential risks. The project did not, at this stage, identify explicit or implicit environmental and/or social risks other than the ones discussed in that Section.

Page left intentionally Blank

PART III: IMPLEMENTATION ARRANGEMENTS

1. PROJECT MANAGEMENT
2. PROJECT AND FINANCIAL RISK MANAGEMENT
3. PROJECT ENVIRONMENTAL AND SOCIAL POLICY
4. MONITORING AND EVALUATION
5. PROJECT RESULTS FRAMEWORK (LOGICAL FRAMEWORK): MILESTONES, TARGETS AND INDICATORS
6. ALIGNMENT WITH ADAPTATION FUND RESULTS FRAMEWORK

7. Budget (Excel sheets, also provided as Annex II)
   Sheet 1: Summary project budget
   Sheet 2: Breakdown of the project execution costs (CCOP-TS)
   Sheet 3: Implementing Entity (MIE) management fee (UNESCO)
   Sheet 4: Budget disbursement schedule with time-bound milestones.
   Sheet 5: Detailed project budget, Excel format (Annex only)

1. PROJECT MANAGEMENT

Introduction
The arrangements for effective and efficient project implementation and management are introduced. First, project 'ownership' arrangements at overall project level are presented, including coordination arrangements by UNESCO as MIE and CCOP-TS as Executive Entity. Regional and national coordination within countries is also clarified. Actual and prospective partnership arrangements with national institutions are discussed and it is elaborated how national and regional partners as National Implementing Entities (NIE) will play a role in project implementation and management.

On the basis of this application and following project preparatory consultations and arrangements, the following entities will support project implementation and management.

Who is Who: Beneficiaries and stakeholders – NIEs

1. Government of Cambodia, Ministry of Water Resources and Meteorology and Ministry of Mines and Energy deal with GW issues in Cambodia.

2. Government of Lao PDR, Ministry of Natural Resources and Environment (MoNRE), and its subsidiary Department for Water Resources (DWR) including the Groundwater Management Division. Furthermore, the Natural Resources and Environment Institute (NREI) has an executive role in GW management.

3. Government of Myanmar, Ministry of Agriculture and Irrigation and within the Ministry of Water Resources the Utilization Department (WRUD) has the role of implementing agency.

4. Government of Thailand, Ministry of Natural Resources and Environment; within the Ministry the Department of Groundwater Resources has the responsibilities in planning, assessment, resource conservation, and regulations.

5. Government of Vietnam, MoNRE as the coordinating Ministry for water resources management, is implementing river basin water resources management plans on a national scale that include GW. The National Center for Water Resources Planning and Investigation (NAWAPI), has an executive role.

6. Universities, research institutions and local NGOs in the GMS and specifically active in the proposed pilot areas and in a position to contribute to capacity building on GW. A specific role is envisaged for the Mekong River Commission and the National Mekong Commissions in the respective riparian countries.

The collaboration will be supported by:

UNESCO: as MIE, it will provide all technical backstopping, facilitation with member States and processes with the Adaptation Fund.

Technical Secretariat of CCOP (CCOP-TS): Coordinating Committee for Geosciences Programmes (in East and Southeast Asia): CCOP-TS, as Executive Entity (EE) will provide technical expertise and coordinate and support implementation along with the national partners.

International Water Management Institute (IWMI): has been at the forefront of research aimed at exploring opportunities for improved GW development and management for poverty alleviation and improving GW governance across SE Asia. IWMI will be one of the implementing partners.

International Groundwater Resources Assessment Centre (IGRAC): is UNESCO's and WMO's GW expertise and resources centre that facilitates and promotes information and knowledge sharing required for sustainable development, management and governance of transboundary GW.

Multilateral Implementing Entity (MIE)
As endorsed by the signatories from the five participating countries, UNESCO-Bangkok Office will be the MIE for the project. Firstly, a short overview of UNESCO's track record in the subject matter is presented. Secondly, it is elaborated in what way UNESCO, as MIE, will manage the project

UNESCO and water management, including groundwater
UNESCO works to build the scientific knowledge base to help countries manage their water resources in a sustainable way through its IHP, through leading the UN-wide World Water Development Programme, through the IHE Delft Institute for Water Education in the Netherlands, through over 20 affiliated research centres on water around the world and through a series of water-related UNESCO Chairs.

The IHP is the only intergovernmental programme of the UN system devoted to water research, water resources management, and education and capacity building. Since its inception in 1975, IHP has evolved from an internationally coordinated hydrological research programme into an encompassing, holistic programme to facilitate education and capacity building, and enhance water resources management and governance. IHP facilitates an interdisciplinary and integrated approach to watershed and aquifer management, which incorporates the social dimension of water resources, and promotes and develops international research in hydrological and freshwater sciences. IHP is in its eighth phase covering 2014-2021. IHP-VIII brings innovative methods, tools and approaches into play by capitalizing on advances in water sciences, as well as building competences to meet the challenges of today's global water challenges.

Under IHP VIII GW is one of the main areas where IHP is continuing its pioneering work to learn more about the complexity of aquifer systems, the increasing global risk to GW depletion, quality deterioration and pollution, and the resilience of communities and populations dependent on GW sources.

Objectives include promoting measures addressing the principles of sustainable management of GW, addressing methods for the sound development, exploitation and protection of GW resources, developing new GW resource maps, and strengthening GW governance policy and water user rights in emergency situations. These challenges call for comprehensive research, implementation of new science-based methodologies and the endorsement of principles of integrated management, and environmentally-sound protection of resources.

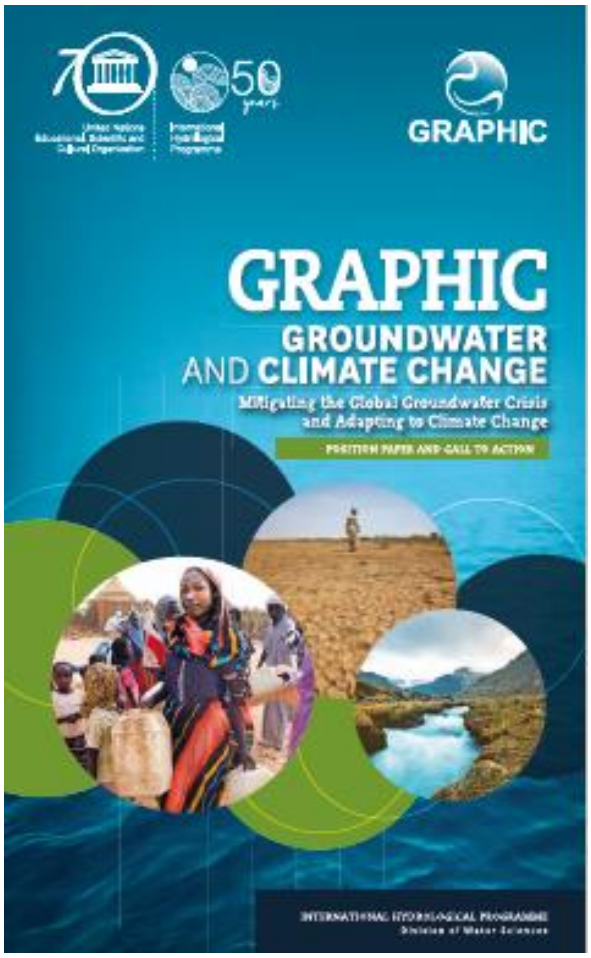
Focal Areas of IHP VIII GW
Focal area 2.1 - Enhancing sustainable GW resources management
Focal area 2.2 - Addressing strategies for management of aquifers recharge
Focal area 2.3 - Adapting to the impacts of climate change on aquifer systems
Focal area 2.4 - Promoting GW quality protection
Focal area 2.5 - Promoting management of transboundary aquifers

Ongoing main Initiatives under UNESCO-IHP:

GRAPHIC (Groundwater Resources Assessment under the Pressures of Humanity and Climate Change) is a UNESCO-IHP project seeking to improve our understanding of how GW interacts within the global water cycle, how it supports ecosystems and humankind and, in turn, responds to complex and coupled pressures of human activity and climate change. GRAPHIC was developed to successfully achieve these objectives within a global context and represents a collaborative effort that serves as an umbrella for international research and education.

Through a variety of regional working groups and case studies, GRAPHIC outlines areas of international research, covering major geographical regions, GW resource topics, and methods to help advance the knowledge required to address both the scientific and social aspects of this field. Comprehensive information is provided in:
http://www.unesco.org/new/fileadmin/MULTIMEDIA/HQ/SC/pdf/2015_GRAPHIC_GWandCC.pdf

Figure 17: The Graphic Programme of UNESCO-IHP Groundwater and Climate Change (Brochure cover).



The **worldwide ISARM (Internationally Shared Aquifer Resources Management)** Initiative is an UNESCO and International Association of Hydrogeologists (IAH) led multi-agency effort aimed at improving the understanding of scientific, socio-economic, legal, institutional and environmental issues related to the management of transboundary aquifers (http://isarm.org/).

The issue of shared international waters is as old as the national borders that make those waters international. During the last century, significant progress was made in regulation of joint management of surface watercourses; many international river-, lake- or basin commissions have been set up and the legal treaties signed. Although some of these activities address "a GW component" as well, major comparable efforts related to the invisible GW have started just a few years ago with the ISARM Programme.

Since its start in 2002, ISARM has launched a number of global and regional initiatives. These are designed to delineate and analyse transboundary aquifer systems and to encourage riparian states to work cooperatively toward mutually beneficial and sustainable aquifer development. Comprehensive information is provided in: (http://en.unesco.org/themes/water-security/hydrology/programmes/isarm/general-information).

The World-wide Hydrogeological Mapping and Assessment Programme (WHYMAP) was created in 1999 in order to contribute to worldwide efforts towards better managing the Earth's water resources, particularly GW. It is a joint programme of UNESCO, the Commission for the Geological Map of the World, the IAH, the International Atomic Energy Agency and BGR. General information is provided at:
http://en.unesco.org/themes/water-security/hydrology/programmes/whymap/resources

'Groundwater for Emergency Situations' (GWES). The aim of the GWES project is to consider natural catastrophic events that could adversely influence human health and life and to identify in advance emergency GW resources resistant to natural and man-made disasters that could replace damaged public and domestic drinking water supplies. A very important aspect of the GWES project, in drawing the attention of governments, organizations and individuals to the concept of preparedness for establishing alternative drinking water supplies, is empowerment. Very often a local population is rendered helpless following a disaster, cut off from its traditional water supplies and faced with delays in aid from outside. This may lead to destabilization and demoralization at a time when people need to rebuild their lives (http://unesdoc.unesco.org/images/0019/001921/192182e.pdf).

UNESCO Bangkok Office:
Since 1961, UNESCO Bangkok Office, the Asia-Pacific Regional Bureau for Education and Cluster Office for the six "Mekong" countries, Thailand, Myanmar, Lao PDR, and Singapore, and indirectly through UNESCO country offices in Hanoi and Phnom Penh, promotes peace and human development through education, sciences, culture, communication and information.

As Cluster Office for the "Mekong" countries and Singapore, UNESCO Bangkok covers all UNESCO's fields of competence: education, sciences, culture, communication and information. It is responsible for UNESCO's

activities directly in Thailand, Myanmar, Lao PDR and Singapore, and indirectly in support of UNESCO Country Offices in Hanoi and Phnom Penh.

While UNESCO's work within the cluster generally emanates from Bangkok Office, this office is cognizant of the importance of relying on staff and partnerships in every cluster country. Across the different cluster countries this takes various forms. UNESCO Bangkok works closely with the UNESCO National Commissions of all of these countries to ensure a strong working partnership, and as a means of maintaining close relationships with governments and civil society. In Thailand, UNESCO Bangkok acts as country office and coordinates all UNESCO's sectorial activities in the country. In Vietnam and Cambodia, UNESCO has established country offices. The Bangkok Office has a supporting role, with the majority of UNESCO's work going through the country offices. In Myanmar, UNESCO Bangkok has a Project Office in place, with coordination from Bangkok. In Lao PDR, while UNESCO's work is coordinated through Bangkok, there are a number of professional staff travelling to the country, and one staff resident in Vientiane, who ensures the smooth implementation of projects in the countries.

The Natural Sciences Sector portfolio was created at UNESCO Bangkok Office in response to increased demands for regional cooperation and international attention to issues pertaining to the Mekong Cluster Natural Sciences Sector. The Natural Sciences Sector serves Mekong Cluster countries in areas including: Water Sciences –IHP; Ecological Sciences – Man and the Biosphere Programme; Science Policy for Sustainable Development; cross-cutting issues such as climate change; as well as disaster risk reduction. The Bangkok office also acts as an adviser for Asia and Pacific on the International Geosciences and Geoparks Programme.

Complementing the work carried out by the UNESCO Natural Sciences Sector, Bangkok Unit, will be the IOC Regional Secretariat (Office) for the Sub-Commission for the Western Pacific (WESTPAC), established in 1994 and currently hosted by the Government of Thailand through its Ministry of Natural Resources and Environment.

MIE Management tasks
The following implementation support under the MIE modality will be provided by UNESCO for the project:

- Overall coordination and management of UNESCO's MIE functions and responsibilities, and the facilitation of interactions with the Adaptation Fund Board and other relevant parties;
- Oversight of project implementation through close interaction with the project Executive Entity CCOP-TS and with the Project Steering Committee (PSC) and reporting to AF on progress and on budget performance;
- Quality assurance and accountability for outputs and deliverables during project implementation and upon completion;
- Receipt, management and disbursement of AF funds in accordance with the financial standards of the AF;
- Assurance of national government support, continued participation and uptake of results.

UNESCO as MIE and as part of its project management responsibility will appoint through an open competition a **Project Manager** (**PM**) who will oversee the implementation of the project along the tasks outlined above. There will be close cooperation between the PM (part-time position, filled by UNESCO Bangkok Office) and the project executive and operational levels (i.e., with Project Director, Coordinating Technical Advisor CTA and CCOP-TS support staff). Through the official network of UNESCO Bangkok Office in the five participating countries and its Head Office UNESCO as MIE, the PM will be able to actively support project implementation and have regular contact with the Executing Agency (CCOP-TS, also in Bangkok) over the course of the AF project implementation.

Project Execution
In accordance with its standards and procedures, UNESCO will enter into a contractual agreement with the coordinating executing partner, CCOP-TS, towards the execution of the AF project activities and delivery of the proposed outputs.

The **Project Director (PD)** will be responsible for the overall management of the AF project. The PD (a part-time position taken by CCOP-TS Executive Director will ensure that the project is run transparently and effectively in accordance with AF and UNESCO's guidelines and approved work plans and budgets. The PD will receive project support from the CCOP-TS project finances manager as well as additional staff members within CCOP-TS. The key functions of the PD will be:

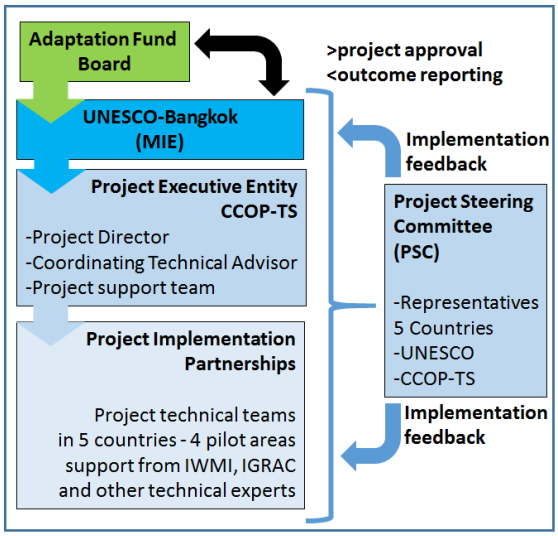
- Facilitating the day-to-day functioning of the project support staff;
- Managing human and financial resources in consultation with UNESCO and the project CTA to achieve results in line with the outputs and activities outlined in the project document;
- Ensure gender analysis and gender monitoring are undertaken by experts;
- Leading the preparation and implementation of annual results-based work plans and logical frameworks as endorsed by the management of UNESCO;
- Monitoring project activities, including financial matters, and preparing monthly and quarterly progress reports, and organising monthly and quarterly progress reviews;
- Together with UNESCO Bangkok Office, organizing PSC meetings;
- Regular reporting and providing feedback on project strategies, activities, progress, and barriers to UNESCO, PSC and project partners; and
- Supporting UNESCO to manage relationships with project stakeholders including donors, NGOs and government agencies

A **Coordinating Technical Advisor (CTA)** will be hired by CCOP-TS to assist the PD and provide technical guidance and support for the implementation of the project. The CTA will:

- Prepare Annual Work plans, TORs for technical consultancies and supervision of consultants' work;
- Assist in monitoring the technical quality of project M&E systems, including annual work plans, indicators and targets;
- provide advice on suitable approaches and methodologies for achieving project targets and objectives;
- provide a technical supervisory function to the work carried out by any other technical consultants hired by the project; and
- assist in knowledge management, communications and awareness raising.

The CTA position will be filled through a transparent and competitive recruitment process that will commence as soon as the Full Project Proposal is approved.

Figure 18: AF project management arrangements.



Step-by-step implementation strategy

- Organise an executive project team consisting of national experts from the five partner countries, and experts from the supporting Technical Assistance partners (CCOP-TS, IWMI, IGRAC). As MIE, UNESCO will convene a PSC.
- Develop a common view and understanding of the role that improved GW management shall play in strengthening climate resilience in multiple sectors; identify additional opportunities through transboundary collaboration; sharing information, expertise and collaborative policies for climate resilience.
- Resource assessment: common methodology to be adopted and approach to data collection/sharing; agree on protocols for sharing available data on transboundary aquifers.
- Compile various maps / information services and products available from countries/organisations and further demarcate the recharge and extraction zones and consider transboundary issues.
- Identify data gaps and need for new data; collaborative monitoring approach, initiate base-level monitoring.
- Common approach for GW resources management information system, basic functions and operations, training expert users, dissemination to end-users in the five countries.
- Raise stakeholder and public awareness on GW vulnerability through development of tailored information for sectoral users and multi-media awareness for urban and rural populations.
- Build capacity of local GW management professionals, planners and policy makers in the pertinent national government organisations.

- Consult stakeholders and develop a process of ongoing engagement with the specific actors with interest in GW from government, donors, NGO's and the private sector.

These activities collectively serve to create the environment needed to achieve positive change on the ground throughout the GMS by reducing vulnerability and increasing adaptive capacity to the impacts of climate change, including climate variability. Clear indicators to track and demonstrate these outcomes will be developed at an early project stage and monitored by the PSC and activities adjusted as needed.

Terms of Reference for Project Steering Committee (PSC)

The PSC will be formed to keep abreast of the project progress and to facilitate the implementation of the project, while direct implementation of the project and decisions regarding the allocation of resources and assistance under the project will be taken by UNESCO as the MIE and CCOP-TS as EE. The PSC will:

- Facilitate the implementation of the project to achieve progress on time, on scope and on budget
- Review progress reports submitted by the Project Team
- Support the broader dissemination of the project's results, especially towards government entities and policy-makers.

PSC Members: One PSC member from each participating country will be invited through the appropriate governance channels. Hence, the PSC will have five (country) members. Chair will rotate every year. UNESCO as MIE and CCOP-TS will attend, as well as CTA.

PSC Meetings: The PSC will meet quarterly throughout the lifetime of the project and may meet more often as required. A calendar of meetings will be developed at the project inception workshop. Whether virtual meetings can serve after at least two successful in-person meetings have been held will be assessed.

Secretariat function: CCOP-TS as EE will provide secretariat services for the PSC by coordinating meetings, producing documentation and meeting minutes, managing correspondence, information management/ dissemination and related tasks.

Documents will be made available to PSC members at least one month prior to the meetings. Minutes of the meetings will be prepared by UNESCO & CCOP-TS. Members of the PSC will share information with non-member stakeholders.

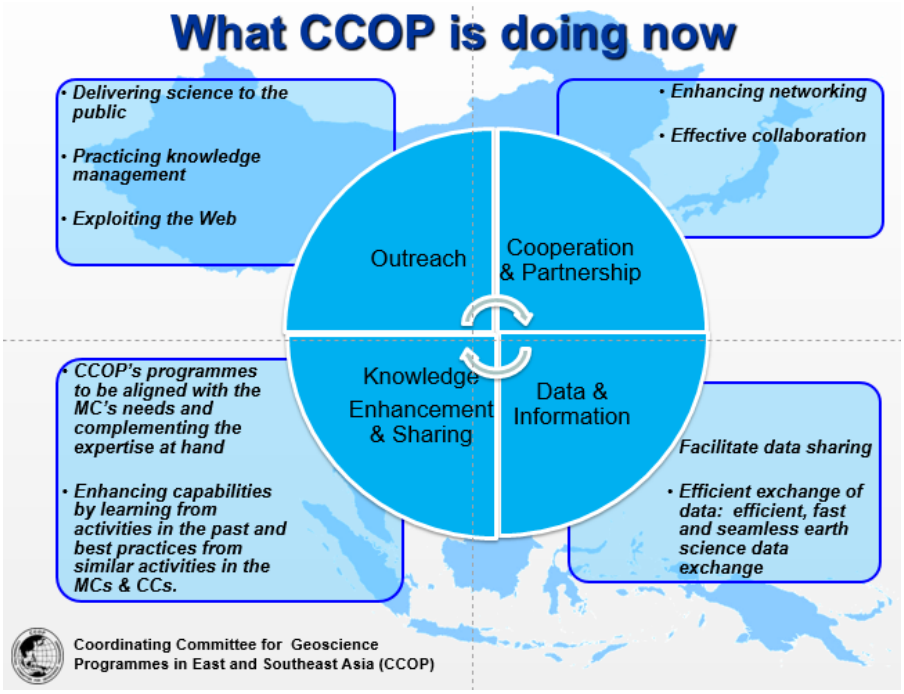
CCOP-TS for project execution

For this project CCOP-TS is the designated project Executive Entity (EE) . Below, CCOP-TS is briefly introduced and its project management and coordination qualifications highlighted. For a useful introduction and overview, please also consult www.ccop.or.th

CCOP, established in 1966, is one of the oldest intergovernmental organisations in East and Southeast Asia. Its mission is to contribute significantly to the economic development and sustainable management of the environment of the quality of life of its Member countries by the application of Earth sciences knowledge. Its focus is on:

- **Outreach**: to enhance influence with decision-makers, investors and the general public through the provision of relevant earth system science information and to develop appropriate skills to communicate effectively with stakeholders in the CCOP member countries.
- **Cooperation and partnerships**: to enhance the internal and external partnerships to improve the quality, reach, application and impact of earth sciences information and knowledge
- **Knowledge enhancement and sharing**: to manage, promote, share and exploit the region's earth sciences information and skills
- **Data and information:** to advance sharing of data and information and integrate earth sciences data across national boundaries
- CCOP's primary network consists of the 14 member countries: Cambodia, China, Indonesia, Japan, Republic of Korea, Lao PDR, Malaysia, Myanmar, Papua New Guinea, Philippines, Singapore, Thailand, Timor-Leste and Vietnam. Additionally, it maintains close ties with a considerable number of Cooperating Countries and Cooperating Organisations. The management and organization structure of CCOP and CCOP-TS is presented below. At the beginning of 2016 CCOP-TS had 10 permanent staff, including four earth science experts and six support staff.

Technical cooperation and tasks of CCOP-TS



In response to the requests of the member countries CCOP-TS has organized, coordinated and supported a number of capacity building and technical cooperation workshops, training courses and case studies in three technical sectors, geo-resources, geo-environment and geo-information. Most of these activities have multilateral participation and support, and often include attention for transboundary issues (resource management, data and information sharing, harmonization). CCOP-TS also supports specific bilateral technical cooperation. For instance, in 2014 there were 26 training/ workshop activities were carried out that were attended by over 890 participants from all member countries. One of the tasks of CCOP-TS is to ensure workshop results and deliverables are prepared and disseminated (reports, books, database content, website, etc.). CCOP-TS also prepares a regular Newsletter.

CCOP-TS Director and senior experts have the responsibility to continuously liaise with member countries and organisations, ensure donor support and prepare technical meetings. CCOP-TS budget derives mainly from membership fees, income from project execution and support and occasional grants, while its expenditure consists of personnel expenses and operational costs. Its offices are provided by the Royal Thai Government through an arrangement with MoENR and include office workspace and facilities, meeting rooms and services.

CCOP-TS capabilities as a network organization are complemented with thorough and high-level expertise in the subject matter. As part of the 'Geo-Resources' CCOP-TS and its partners have worked on sustainable management of GW for a considerable time. There is also relevant expertise in the 'Geo-Information' programme. In all, CCOP-TS is well placed to be tasked with execution of the proposed project.

CCOP-TS Groundwater related project involvement (since 2004)

1. **General GW Resources**
   CCOP-GSJ/AIST GW Project (2004-2015)
   - Phase I: Groundwater Assessment along Great River Basins in East and Southeast Asia (2004-2009)
   - Phase II: Groundwater Assessment and Control in the CCOP Region (2010-2014)
   - Phase III: As a groundwater component of the CCOP-GSJ Project "Development of Geo-Information sharing infrastructure for ASEAN/CCOP countries" (started 2015)
   - Project: "Development of Renewable Energy for Ground-Coupled Heat Pump system in CCOP Regions"
   - Groundwater and Bottled water market
   - CCOP-BGR-NAWAPI, Vietnam Workshop, Integrated water resource management in coastal zones with a focus on Groundwater Experiences in East and Southeast Asia Countries, Can Tho, Vietnam, 19-21 January 2016
   - CCOP-KIGAM Workshop (Sihanoukville, Cambodia), 1-4 June 2016 Groundwater management and Climate Change Adaptation in the Lower Mekong Basin.

2. **GW – Environmental and Geohazard Issues**
   - CCOP-KIGAM Project "Solutions for Groundwater problems in CCOP region" (2013-2017)

- CCOP-Panya Consultant-DGR Land Subsidence Monitoring System Design Project Workshop/Meeting, 16-22 January 2011, Bangkok, Thailand
- The 6th JPDC-KIGAM-CCOP Jeju Water Forum on 6-9 October 2014 in Jeju, Republic of Korea
- BGR – CCOP Workshop "Integrated water resource management in coastal zones with a focus on GW – experiences in East and Southeast Asia countries"

3. Deep GW Programme

- PETRONAS-PETRAD-INSTOCK-CCOP Deepwater Subsea tie-back in Kuching, Malaysia on 24-26 January 2011
- Deep GW Resources (project proposal ready, implementation waiting for external funding)

Collaboration with groundwater user organizations

In the proposed pilot areas GW user organizations (if existent) or other stakeholder groups will be engaged in the project. They may be regarded the primary beneficiaries of the project and will be involved in the development, application, evaluation and wider dissemination of GW-based resilience strengthening measures. GW user organizations will be supported (stimulated when they are embryonic or not yet set up), and subsequently will be:

- Actively supporting collection of GW data
- Participating in development of GW management information products
- Supporting validation of resilience strengthening measures
- Strengthened to be able continue contributing to sustainable GW management as part of CCA resilience
- Evaluating and providing feedback on project interventions and impact

For the project management GW user organizations are the most important group of project stakeholders that will validate the impact of the project.

NB. GW user organizations are not directly involved in Project Management *sensu stricto* (as this comment is raised under the Section related to Project Management.

2. Project and Financial Risk Management

A number of potential project and financial risks have been considered and analysed in the process leading up to this Adaptation Fund proposal. These are summarized in Table 8 below. The risk management strategy of this AF project will be further fine-tuned during the project Inception phase.

No	Risk	Classification	Impact/ Probability 1: Low 5: High	Mitigation Measure
1	National policy and institutional practices undermine the development of concrete resilience measures in the pilot areas	Institutional	Impact: 4 Probability: 1	The project will work on different intervention levels, from national natural resources management and CCA policy in the five countries (national ministerial level), as well as on regional (responsible agencies and sub-ministerial) level and stakeholder group organisations, to local level through direct interaction with primary stakeholder groups.
2	Data availability and consistency is inadequate to design trusted and acceptable resilience measures.	Environmental	Impact: 3 Probability: 3	The project will follow a step-by-step approach, with simple and low-threshold initiatives first, and then gradually develop more complex and higher impact practices.
3	Resilience measures increase inequity in communities	Environmental and Social	Impact: 3 Probability: 2	Local level implementation through farmer and other GW user groups will ensure that resilience measures are demonstrated on the basis of participative processes which are gender-sensitive and enable participation of vulnerable and marginalized groups.
4	Political and safety situation is not supportive of field visits and working with stakeholders in pilot areas	Social, Political	Impact: 4 Probability: 1	Pilot areas have been selected with this in mind. Different pilot areas can be selected, but only if this has to be done early on in the project.
5	Technical support capabilities and budgets from the project are inadequate.	Institutional	Impact: 3 Probability: 2	The project is relying on a participative approach through its engagement with national partners and local stakeholders in the pilot areas. This will stimulate ownership and allow for collaboration with local initiatives and will muster support from national and international partners.

Table 8: Project risks and mitigation measures.

3. Project Environmental and Social Policy

The proposed project seeks to fully align with the Adaptation Fund's Environmental and Social Policy (ESP). Summarized below is the initial analysis that has been carried out to evaluate environmental and social impacts of the project versus the Adaptation Fund policy. Also, it indicates where steps will be taken and where further assessment is needed.

Table 9 provides an overview of potential risks, screening procedures and mitigation measures for the four pilot areas. Once the exact site, target groups and types of GW use have been defined, a risk screening and mitigation plan for each pilot area will be prepared.

Potential Risk	Screening/Monitoring	Mitigation/ruling out
Resilience measures increase inequity in communities	Screening trough the contacts of local farmers and other GW user groups	Local level implementation through farmer and other GW user groups will ensure that resilience measures are demonstrated on the basis of participative processes which are gender-sensitive and enable participation of vulnerable and marginalized groups.
Endangering of natural habitats	Screen pilot area for critical national habitats	Activities will not take place in critical national habitats
Insufficient trust among aquifer sharing country in pilot area	Screening to trust building via participatory activities of riparian/aquifer sharing countries	The project will follow a step-by-step approach, with trust building and joint fact finding to gradually develop more complex and higher impact practices.
Resilience measures increase gender inequity in communities	Screening trough the contacts of local farmers and other GW user groups	By identifying women who are key users and beneficiaries of GW, the project is prioritizing understanding on their access to, use and management of GW. Women and vulnerable groups will be identified in the Inception Phase and the gender component will be monitored throughout the Project Implementation Phase. The training will also include a component on awareness raising among local stakeholders, with emphasis on women and marginalized communities engaged in or aspiring to be engaged in GW use for domestic supplies, crop production, issues related to GW use and protection, and means to access necessary technogy, markets, and community-based monitoring and management.
Resilience measures affect water quality and energy efficiency	Implementation of applicable standards of energy efficiency use	The pilot projects will be designed and implemented in a way that meets applicable international standards for maximizing energy efficiency and minimizing material resource use, the production of waste, and the release of pollutants (not expected).
Loss of ecosystem services and biodiversity	Monitoring ecosystem services (supporting, regulation, provisional and cultural)	Environmental NGOs with a local presence and/or relevant Ministries will assess any significant changes and how to modify the projects to mitigate them.

Table 9: Overview of potential risks, screening procedures and mitigation measures for the four pilot areas.

Dissemination of climate and GW information, sharing of knowledge and capacity building activities will be done in a manner that respects the principles of gender equity, access and equality, be sensitive to the needs of marginalized and vulnerable groups, and according to the prepared risk mitigation plan for each pilot area. For example, by identifying women who are key users and beneficiaries of GW, the project is prioritizing understanding on their access to, use and management of GW. The training will include a component on awareness raising among local stakeholders, with emphasis on women and marginalized communities engaged in or aspiring to be engaged in GW use for domestic supplies, crop production, issues related to GW use and protection, and means to access necessary technogy, markets, and community-based monitoring and management.

Based on our assessment of the expected interventions we deem it most appropriate to classify the project as "C".

Activities under Component 1 to 5 are in general all "soft" activities. According to the Adaptation Fund's ESP, "Those projects/programmes with no adverse environmental or social impacts should be categorized as Category C" (Source: Adaptation Fund Environmental and Social Policy document.) No negative environmental and social impacts, whether direct, indirect or cumulative are envisaged to arrive as a result of any of the soft activities under Components 1 to 5. Despite this, however, utmost care will be taken to ensure that no detrimental environmental or social impacts can occur.

As elaborated throughout the proposal the project specifically aims to deliver positive transboundary impacts.

The miscellaneous field activities that will be formulated in detail for the implementation of the designated pilot areas need to be scrutinized more closely. Some of these may be considered 'hard' activities, and as such have the potential, without environmental and social safeguarding and mitigation measures, to have minor negative environmental and social impacts. However, in our assessment, none of the proposed activities is expected to be in Category A or B of the Adaptation Fund's impact classification. This is because this project proposes potentially 'hard' activities that are small scale and very localized, and co-managed by local communities where possible, who have a stake in avoiding negative environmental and social impacts. This means that the potential for direct impacts is small and localized, that there can be few indirect impacts, Given this, cascading or cumulative negative impacts are also unlikely.

The checklist provided in the Adaptation Fund guidelines for project funding document has been scrutinized and is provided below.

	Checklist of environmental and social principles	No further assessment required for compliance	Potential impacts and risks – further assessment and management attention to be considered.
1	Compliance with the Law; Projects/programmes supported by the Fund shall be in compliance with all applicable domestic and international law.	X	The project's intervention and impact domain does not touch upon this principle. It will operate within the prevailing laws and regulations of the partner countries and potentially applicable international laws.
2	Access and Equity; Projects/programmes supported by the Fund shall provide fair and equitable access to benefits in a manner that is inclusive and does not impede access to basic health services, clean water and sanitation, energy, education, housing, safe and decent working conditions, and land rights. Projects/ programmes should not exacerbate existing inequities, particularly with respect to marginalized or vulnerable groups.	X √	The project's intervention and impact domain does directly touch upon this principle; Access to low-cost and stable water supply for primary livelihood and WASH purposes will be supported for all on an equal basis but priority will be given to vulnerable and low-income groups. Planned activities will be scrutinized in semi-annual workplans and closely monitored.

3	Marginalized and Vulnerable Groups: Projects/programmes supported by the Fund shall avoid imposing any disproportionate adverse impacts on marginalized and vulnerable groups including children, women and girls, the elderly, indigenous people, tribal groups, displaced people, refugees, people living with disabilities, and people living with HIV/AIDS. In screening any proposed project/programme, the implementing entities shall assess and consider particular impacts on marginalized and vulnerable groups.	X√	The project's intervention and impact domain does indirectly touch upon this principle; Vulnerable groups will be supported in their access to low-cost and stable water supply. Project documentation will be provided and community awareness meetings will be held to vulnerable groups to ensure consultation and compliance.
4	Human Rights: Projects/programmes supported by the Fund shall respect and where applicable promote international human rights.	X√	The project's intervention and impact domain does indirectly touch upon this principle; the fundamental right to water as a source for basic livelihood will be strengthened. Although adverse impacts are not expected, this aspect will be closely monitored.
5	Gender Equity and Women's Empowerment: Projects/programmes supported by the Fund shall be designed and implemented in such a way that both women and men (a) have equal opportunities to participate as per the Fund gender policy; (b) receive comparable social and economic benefits; (c) receive comparable social and economic benefits; and (b) do not suffer disproportionate adverse effects during the development process.	X√	The project's intervention and impact domain will touch upon this principle; it will positively pursue and support gender equity and women's involvement through its core approach for direct stakeholder involvement in resource management. This aspect will be closely monitored for positive impacts and will be one of the outcomes of the project.
6	Core Labour Rights; Projects/programmes supported by the Fund shall meet the core labour standards as identified by the International Labor Organization.	X	The project's intervention and impact domain does not touch upon this principle.
7	Indigenous Peoples: The Fund shall not support projects/programmes that are inconsistent with the rights and responsibilities set forth in the UN Declaration on the Rights of Indigenous Peoples and other applicable international instruments relating to indigenous peoples.	X	The project's intervention and impact domain does not touch upon this principle.
8	Involuntary Resettlement; Projects/programmes supported by the Fund shall be designed and implemented in a way that avoids or minimizes the need for involuntary resettlement. When limited involuntary resettlement is unavoidable, due process should be observed so that displaced persons shall be informed of their rights, consulted on their options, and offered technically, economically, and socially feasible resettlement alternatives or fair and adequate compensation.	X	The project's intervention and impact domain does not touch upon this principle.
9	Protection of Natural Habitats: The Fund shall not support projects/programmes that would involve unjustified conversion or degradation of critical natural habitats, including those that are (a) legally protected; (b) officially proposed for protection; (c) recognized by authoritative sources for their high conservation value, including as critical habitat; or (d) recognized as protected by traditional or indigenous local communities.	X√	The project's intervention and impact domain does indirectly touch upon this principle; the project will prioritize conservation of natural habitats when these contribute to GW recharge processes and storage (ecosystem services). The project specifically aims to avoid adverse impacts. This aspect will be closely monitored for positive impacts and will be one of the outcomes of the project.
10	Conservation of Biological Diversity: Projects/programmes supported by the Fund shall be designed and implemented in a way that avoids any significant or unjustified reduction or loss of biological diversity or the introduction of known invasive species.	X	The project's intervention and impact domain does not touch upon this principle.

11	Climate Change: Projects/programmes supported by the Fund shall not result in any significant or unjustified increase in greenhouse gas emissions or other drivers of climate change.	X√	The project's intervention and impact domain does indirectly touch upon this principle; Project implementation will not have adverse climate change impacts. Further measures or interventions developed under the project and proposed for future implementation will be examined for possible adverse climate change effects. This aspect will be closely monitored.
12	Pollution Prevention and Resource Efficiency; Projects/programmes supported by the Fund shall be designed and implemented in a way that meets applicable international standards for maximizing energy efficiency and minimizing material resource use, the production of wastes, and the release of pollutants.	X√	The project's intervention and impact domain does indirectly touch upon this principle; Resource use and aquifer recharge will be developed in an energy-efficient manner and by taking utmost care for protecting existing resources from pollution. Project implementation will not have adverse impacts. Further measures or interventions developed under the project and proposed for future implementation will be examined for possible adverse effects. This aspect will be closely monitored.
13	Public Health: Projects/programmes supported by the Fund shall be designed and implemented in a way that avoids potentially significant negative impacts on public health.	X√	The project's intervention and impact domain does indirectly touch upon this principle; Access to low-cost and stable water supply for primary livelihood and WASH purposes will be supported. This aspect will be closely monitored for positive impacts and will be one of the outcomes of the project.
14	Physical and Cultural Heritage; Projects/programmes supported by the Fund shall be designed and implemented in a way that avoids the alteration, damage, or removal of any physical cultural resources, cultural sites, and sites with unique natural values recognized as such at the community, national or international level. Projects/ programmes should also not permanently interfere with existing access and use of such physical and cultural resources.	X√	The project's intervention and impact domain touch upon this principle, namely because of the presence of Angkor Wat World Heritage site in NW Cambodia. GW management is extremely important in view of the high demand (tourism) and the detrimental effects of large extractions on the site (notably land subsidence), leading to structural damage. The project will dedicate specific attention to support the mitigation of these risks throughout consultation with governmental bodies. UNESCO, as the only UN agency with a mandate in the field of culture, will implement intersectoral collaboration to ensure prevention of damage to cultural heritage sites.
15	Lands and Soil Conservation; Projects/programmes supported by the Fund shall be designed and implemented in a way that promotes soil conservation and avoids degradation or conversion of productive lands or land that provides valuable ecosystem services.	X√	The project's intervention and impact domain does directly touch upon this principle; the overall aim of the project is to support the conservation of soil and lands that provide valuable ecosystem services, such as GW recharge. Project implementation will not have adverse impacts. Further measures or interventions developed under the project and proposed for future implementation will be examined for possible adverse effects. This aspect will be closely monitored.

Table 10: Checklist of project's potential impacts conform guidance document for Implementing Entities on compliance with the Adaptation Fund Environmental and Social Policy.

√ = *The project is expected to generate positive impacts in this marked domain. Once the detailed work plans have been developed, in particular for the direct interventions in the four pilot areas. the project management, monitoring and evaluation approach will be updated to include further verification and assessment of the anticipated positive impacts and absence of adverse impacts.*

Project screening mechanism for environmental and social risks

As applicant and implementing entity (MIE) UNESCO's capacity and commitment to avoiding and reducing environmental and social risks has been assessed and approved by Adaptation Fund as part of the accreditation process for Implementing Entities.

For this proposal, UNESCO clearly acknowledges its responsibility to screen the project and its activities and to determine the extent to which they may present environmental or social risks, including all risks associated with the Fund's environmental and social principles as identified in its Policy. UNESCO and CCOP-TS as implementing and executive agency ensure that the environmental and social impacts have been and will be thoroughly assessed and that if required measures are identified to avoid, reduce or mitigate identified and/or unexpected adverse environmental and social impacts. It will be the task of UNESCO's project M&E team to monitor and report this impact assessment during the project. As the project will focus on implementation of activities in the four pilot areas this process will largely take place at the (sub)national and regional levels, in the following manner:

For each pilot area:

1. Semi-annual workplan upon preparation and approval assessed by means of checklist on each of the fifteen Environmental and Social Core Principles (AF guidance document). Activities (in)directly applicable to one or more of the ESP core principles will be specifically assessed (ESP principles marked √ in Table 10 above). Screening measures as introduced in Table 9.
2. Upon completion of semi-annual work plans implementers will be specifically requested to report any issues pertaining to adverse environmental and social impacts, and/or mitigation actions implemented or considered.
3. A annual summary statement / communique will be prepared, on the basis of which further public consultations can take place.
4. In each pilot area a small representative committee of local and national stakeholders will be involved. This committee will approve/endorse 1) the overall outcome of the environmental and social impact assessment, and 2) possible mitigation actions for unforeseen adverse impacts. Since the focus of the project will be on implementation in the pilot areas, the implementers deem it essential to consult, and have support from local stakeholders and their representatives. If necessary the grievance mechanism can be applied (see below).
5. National partners, in their supporting roles for the implementation of the project, will be involved in and support steps 1-4. This process is overseen by UNESCO and reported on in semi-annual project meetings. The ultimate responsibility rests with the implementing entity.

UNESCO and CCOP-TS and proposal partners have, in the project formulation and initial screening process (Concept Note and Proposal stage) considered all potential direct, indirect, transboundary, and cumulative impacts in the project's area of influence. This assessment is supported and substantiated by considerable earlier and ongoing GW work of proposal team members in the countries and regions involved. On this basis, the conclusion has been reached that it is not likely, or very unlikely that the proposed interventions will have adverse environmental or social impacts, hence Category C. The above monitoring approach will ensure, in case of doubt and because of unforeseen developments, impacts can be prevented or mitigated.

If, by any measure project implementation does generate unexpected environmental or social impacts, this will be rectified by the IE's M&E team and reported in the project review process. When requested, additional supporting information will be provided. UNESCO and CCOP-TS annual project performance report shall include a section on the status of the ongoing environmental and social impact assessment. These reports include, if necessary, a description of any corrective actions that were taken. The mid-term and terminal evaluation reports shall also include an evaluation of the project's performance with respect to environmental and social risks.

UNESCO and CCOP-TS as IE and EE will prepare the final environmental and social assessment in its reporting to AF and in a suitable format for people, communities and other stakeholders involved in the project. A special section of this report will be dedicated to stakeholders and vulnerable groups in each pilot area.

UNESCO as the MIE will provide an introduction and training to the EE and coordinators at the beginning of the project, to ensure their knowledge and awareness level regarding their responsibilities with regards to the provisions of the Environmental and Social policy of the AF, and the promotion of human rights, including specifically the complaint handling mechanism of the Fund. The ESP of the AF will be used as the main guidance to ensure compliance.

To make sure that all direct beneficiaries of the project and other related stakeholders are aware about the grievance mechanism available in the country and the complaint-handling mechanism of the Fund, in case of non-compliance, the project, under the supervision of UNESCO and CCOP-TS, will produce public information materials (leaflets and brochures) which explain the project, complete with detailed contact persons in charge (name, position, address, phone, fax, email), and including access to information regarding the mechanism for handling complaints of the AF (https://www.adaptation-fund.org/page/mechanisms-handling-complaints). These public information materials will be distributed to direct beneficiaries and related stakeholders during community consultations and awareness activities.

Grievance mechanism

As part of the project's progress and result monitoring stakeholder feedback and reviews will be collected systematically. This will focus on the evaluation of tangible measures and activities in the four pilot areas (the closest connection between stakeholders interests and needs and the intended effects and impacts of the project).

As part of the evaluation process a grievances modality will be set up, both in a general sense (as part of the project's website and information portal, and as part of specific evaluation and progress data collection (M&E). This will allow concerned stakeholders to raise issues (anonymously if they wish), to the project management implementers.

Figure 19 depicts the grievance mechanism process to be implemented in the project. The grievance mechanism process will support receiving, evaluating, and addressing project related grievances from the local communities and other stakeholders. It will be possible to express a grievances via submission on the website, or by phone; a telephone conversation could provide explanations resulting in withdrawal of grievance. Receipt of the grievance will always be acknowledged, recorded and subsequently investigated. Timely response is very important part of the process. Some of the resolved grievances will probably be included in Frequently Asked Questions on the project website in order to prevent unnecessary misunderstandings.

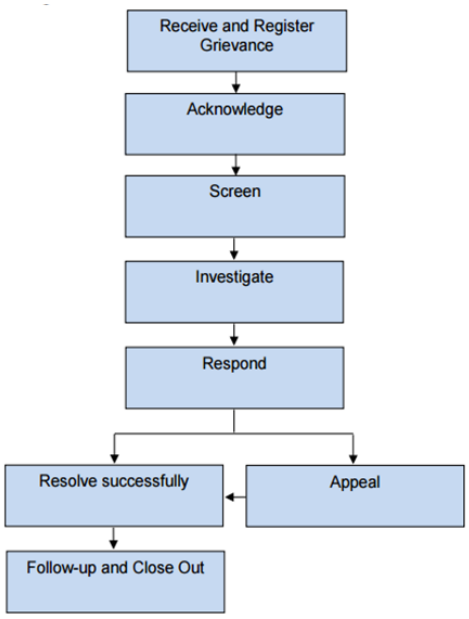


Figure 19: Grievance mechanism process.

4. Monitoring and Evaluation

The monitoring and evaluation (M&E) scheme of the project will be applied in accordance with established UNESCO procedures throughout the project lifetime. The M&E plan will be implemented as summarized in Table 11. Integral management and oversight will be provided by the UNESCO project holder and the CCOP-TS project team. The following are a number of essential ingredients for project M&E.

Project Inception: A Project Inception Workshop will be held within the first three months of the project and with participation of all persons and organizations that have been assigned roles and responsibilities in the project organization. Representatives from the national agencies, technical advisors and stakeholders from the region will contribute to the Inception Workshop. The Inception Workshop is crucial to generate momentum for project implementation and to develop the work plan for the first year of the project.

The Inception Workshop will address a number of key issues including:

a. Assist all national partners to fully understand and take ownership of the project;
b. Specify the roles, support services and complementary responsibilities of the project team and the national partners in the five countries;
c. Discuss the roles, functions, and responsibilities within the project's decision-making structures, including reporting and communication lines, and conflict resolution mechanisms;
d. Confirm the procedures and arrangement to engage project staff;
e. Based on the proposed project results framework, review and finalize the first annual work plan;
f. Verify and agree on project indicators, targets and their means of verification, and recheck assumptions and risks;
g. Provide a detailed overview of reporting, as well as M&E requirements. The M&E work plan and budget should be agreed and scheduled;
h. Discuss financial reporting procedures and obligations, and arrangements for audits; (i) Plan and schedule PSC meetings.
i. Roles and responsibilities of all project organization structures will be clarified and meetings planned. The first PSC meeting will be scheduled directly following the Inception Workshop.

Following the Inception Workshop, an Inception Report will be prepared as a key reference document. The Inception Report will serve as an Annex to the signed project document and shared with participants to formalize various agreements and plans decided during the meeting.

Quarterly reporting: Quarterly project progress will be monitored by UNESCO on the basis of concise project progress reports.

Comprehensive annual reports: Annual project progress reports are comprehensive key reports which are prepared to monitor progress made since project start and in particular for the previous reporting period. The annual progress reports will include at least the following: (a) Progress made toward project objective and project outcomes - each with indicators, baseline data and end-of- project targets (cumulative); (b) Project outputs delivered per project outcome (annual); (c) Lesson learned/good practice; (d) Annual work plan and other activity and expenditure reports; (e) Risk and adaptive management. UNESCO will assess the quality of annual progress reports for completeness, comprehensiveness, analytical rigor and lessons learned.

Periodic monitoring through site visits: UNESCO and CCOP-TS will participate in project work visit and activities on location (activities as in the agreed schedule in the project's Inception Report and Annual Work Plan) to assess first hand project progress. Members of the PSC and Technical Advisory Group may join these visits incidentally. A Field/Activity Visit Report will be prepared by CCOP-TS for circulation no less than one month after the visit to the project team and PSC members.

Mid-term of project cycle: The project will undergo an independent Mid-Term Evaluation which will determine progress being made toward the achievement of outcomes and will identify course correction if needed. It will focus on the effectiveness, efficiency and timeliness of project implementation; will highlight issues requiring decisions and actions; and will present initial lessons learned about project design, implementation and management.

Findings of this review will be incorporated as recommendations for enhanced implementation during the final half of the project's term. The organization, terms of reference and timing of the mid-term evaluation will be decided after consultation between the parties to the project document. The Terms of Reference for the Mid-term evaluation will be prepared by UNESCO based on guidelines from the AF and in line with UNESCO's evaluation policy as updated in 2016 which calls for a minimum of 3% of project costs to be allocated to the evaluation function.

External final project evaluation: An external final project evaluation will take place three months prior to the final PSC meeting. The final evaluation will focus on the delivery of the project's results as initially planned (and as corrected after the mid-term evaluation, if any such correction took place). The final evaluation will look at impact and sustainability of results, including the contribution to capacity development and the achievement of global environmental benefits/goals, as well as the project's relevance, effectiveness and efficiency. The Terms of Reference for this evaluation will be prepared by UNESCO and the project management based on AF programme guidelines and in line with UNESCO's evaluation policy as updated in 2016.

Financial audit: Project audits will follow UNESCO's financial regulations, rules and applicable audit policies.
A final certified and audited financial statement will be sent to the AFB once the project is completed. The external financial audit will be conducted in line with the financial regulations, rules and directives of UNESCO.

Project final reports: During the last three months of the project, CCOP-TS and the implementation team will prepare the Project Final Report. This comprehensive report will summarize the results achieved (Objectives, Outcomes, Outputs), lessons learned, problems met and areas where results may not have been achieved. It will also lay out recommendations for any further steps that may need to be taken to ensure sustainability and replicability of the project's results.

Description	Responsible party	Budget (tentative) excluding staff time	Time frame
Project Inception Workshop	Project management team	15,000	Project start
Inception Report	Project management team		Two weeks after the Inception workshop
Periodic status/ progress reports	Project management team		Quarterly
Meetings of PSC	Project management team, MIE	40,000	Two times in every year of the project (including virtual/Skype meetings)
Annual Progress Reports	Project management team, MIE		End of each year
Mid-Term Evaluation	External evaluation team	36,700	End of year two
External Audit	External auditor	20,000	At project closing
External Final Evaluation	External evaluation team	110,300	Three months before the end of the project
Project final reports	Project management team and MIE		Final concept one months before the end of the project

Table 11: Project reporting and M&E arrangements. The indicative budget reservations are part of the Executive and Implementing Entity reservations. These will be reviewed during the Inception Phase.

5. PROJECT RESULTS FRAMEWORK (LOGICAL FRAMEWORK)

Program Strategy	Objectively verifiable indicators				
	Indicator	**Baseline**	**Target**	**Sources of verification**	**Assumptions and Risks**
Component 1: GW resource assessment and monitoring: to obtain and use a harmonised regional GW resource inventory supporting a regional GMS approach to address challenges of climate change and resilience, and enable an information-based policy to manage resources and further develop new GW-based resilience strategies and practical interventions.					
Outcome: A regional GMS approach to address challenges of climate change and resilience is created based on an information-based policy.	**Indicator**	**Baseline**	**Target**	**Sources of verification**	**Assumptions and Risks**
	Extended management services and supporting hard and soft infrastructure (policy and guidelines, database, monitoring systems, MAR systems) have higher adaptive capacity. At least three services modified per sector (water supply, agriculture, industry). AF Core indicator 7.1	Regional and local authorities have insufficient knowledge to address challenges of climate change	To increase resilience based on a sound, informed management and harmonised regional policy.	Produced policy documents, agreements made, services modified per sector.	Willingness and commitment of local and national authorities to actively engage in the process. Recognition of importance and necessity of CCA, despite of financial limitation and other obstacles.
	Governments and GW expert community and users refer to this GW inventory and use it.	Governments and user groups have incomplete to severely limited knowledge of GW resources and no consistent assessment exists.	A comprehensive overview of regional GW resources (quality, quantity) is included in an easily accessible inventory (GIS, database).	GW resources inventory tool (database and GIS) with content.	National partners are willing to provide data to be included in database.
	GW information (reports, maps, monitoring data) are used in strategies for climate resilience.	There is some GW-related data, but it is hardly used for this purpose.	GW information forms the basis for specific climate resilience measures.	Documentation and evidence for resilience measures application in the pilots.	GW system might not be suitable to support adequate measures (limited quantity, quality issues).

	Monitoring system in place and data being collected in support of operational tool.	GW seen as a static resource (basic inventories) and little or no data on temporal changes exists.	Monitoring system and information is operational and used for periodic updates.	Hard- and software, data files	Expense of periodic data collection might be too high.
	GW resources information supports further climate adaption policy at high policy levels.	Currently, GW information is hardly used.	Clear and consistent reference to GW in support of climate resilience development.	CCA policy documents with reference to GW; GW experts involved in CCA issues.	Project is able to generate tangible results with clear evidence on the ground.
Component 2: Priority use and Stakeholders: Stakeholders from different GW user sectors increasingly participate in decision-making on resource management issues and have access to information and guidelines that support more sustainable use region-wide.					
Outcome 2: GW users including women from different economic sectors in the GMS have access to requisite information and guidelines and thus participate in GW management.	**Indicator**	**Baseline**	**Target**	**Sources of verification**	**Assumptions and Risks**
	In each of the four pilot areas at least two different local GW users' groups (in total 2500 users) are capacitated to use ground-water sustainably for adaptation and climate risk reduction measures. Higher management is also aware and involved (AF core indicator 2.1.1)	Farmers and other users deplete GW resources regardless of CCA challenges.	Multiple users aware of and supported with resource management information and guidelines; support available in transboundary regions.	Attendance of users in resource management meetings/training; guidelines for different water use sectors documented with breakout by sex.	GW users sufficiently aware of CCA challenges.
	GW information is regionally coherent and sufficient to attract interest from users.	Information on GW potential is not tangible enough to motivate users to adopt and apply it.	Supporting national partners dedicated to provide users (in-country and transboundary) with adequate information.	Information products and guidelines published and circulated.	National partners sufficiently enabled to achieve the objectives and targets for the transboundary aquifer system.

Component 3: Resource management, information tools and equipment: will support greater resilience and more sustainable GW resource use, with protection of low income and vulnerable user groups; resource management methodology supports better transboundary GW policies that are more robust and climate change ready.					
Outcome 3: Climate resilience and GW use in pilot areas is increased, and low income and other vulnerable groups' needs are prioritized.	**Indicator**	**Baseline**	**Target**	**Sources of verification**	**Assumptions and Risks**
	Low income and vulnerable groups apply GW based resilience measures. Of targeted population groups 70% is aware of predicted adverse impacts of climate change, and of appropriate responses; 30-50 % of targeted population applying appropriate adaptation responses.	Next to basic resource inventories (GW maps) there is no tailored information to support sustainable resource use or specific measures to support resilience.	Greater resilience and sustainable GW resource use, enabling low income and vulnerable user groups to use GW resources optimally when needed.	Practices of farmers and other user groups that apply resilience measures	Differences in quality of GW system management may be too large to solve within the timeframe of the project.
	Improved exchange of information on transboundary GW management issues.	No transboundary cooperation, incompatible resource inventories, no communication.	Joint and coordinated efforts to use information and tools for monitoring to develop and apply GW management	Database, multi-language information products, shared management tools.	Investments in monitoring equipment may be too costly
	Suite of tools, methods etc. have been prepared		Comprehensive information, tools and methods developed and applied		Underlying data availability may be insufficient to develop useful information products.
Component 4: Regional cooperation, coordination and information exchange will result in the development of a regionally coherent policy for climate adaptation through sustainable GW resource management, a level playing field for GW users from all sectors throughout the region and efficiency gains through a common approach and collaborative support tools.					
Outcome 4: A regionally coherent policy for sustainable GW management in	**Indicator**	**Baseline**	**Target**	**Sources of verification**	**Assumptions and Risks**
	Multi-country or bilateral arrangements to support and	Despite common CCA challenges countries in the region do not	Regionally coordinated GW use contributes to regional, cross-	Multi-country or bilateral consensus documented in	Bilateral relations or specific resource

support of CCA is adopted based on a level playing field of all users in the GMS.	oversee GW management in support of climate resilience objectives.	optimally share practices, knowledge and resources	border climate resilience for food production, rural water supply, etc.	policy documents and similarities in approach.	conflicts may be too serious to overcome.
	Regional coordination recognizes different vulnerabilities and needs of different users. At least three main GW-related policies introduced or adjusted to address climate change risks (one by sector).	Vulnerable groups in the region and suffer from detrimental impact of resource depletion and increasing climate change vulnerabilities.	Collaborative transboundary approach to protect limited resources and support vulnerable groups.	Database, multi-language information products, shared management tools. Introduced and/or adjusted policy documents.	Project is able to transfer the results of regional pilots to higher policy levels.
Component 5: Capacity building and training will enhance the internal capacity of the GW community of experts in the GMS region to develop and contribute to CCA policy and practical resilience enhancing interventions, to use state-of-the-art tools and work with stakeholders and vulnerable groups.					
Outcome 5: GMS stakeholders and communities capably use project tools on GW use for CCA and resilience.	**Indicator**	**Baseline**	**Target**	**Sources of verification**	**Assumptions and Risks**
	A CoP on user-oriented GW management is active Over 25 partnerships and active collaboration set up to support GW management capabilities that strengthen resilience and reduce detrimental climate change impacts.	Within the region different national groups work on rather different knowledge levels and there is little bi- or multilateral cooperation.	CoP of GW experts is able to contribute to CCA policy and practical resilience enhancing interventions.	Proceedings of meetings and collaborative products, joint statements.	Proposed interaction may not evolve to a higher, more effective level.
	Over 120 regional experts support institutional capacity in 5 countries (male/female = 60/40%).	Although there are regional network meetings there is little coordinated effort to improve overall impact level.	Through regional cooperation GW experts have reached a higher and collaborative knowledge and impact level.	General academic level within CoP is raised significantly (more PhD's, more MSc's). Proceedings of meetings and collaborative	There is sufficient support and funding within the region to sustain the envisaged

				products, joint statements.	regional collaboration.
	GW CoP is actively engaged with different stakeholder groups and provides tailored information. Over 750 participants have increased awareness and skills on climate related impacts (male/female = 60/40%).	As above	GW CoP is regionally active and able to contribute effectively to different GW system, sustainability or CCA challenges.	CoP is visible with contributions and input in the regional CCA debate and multilateral coordination processes. Proceedings of meetings and collaborative products, joint statements.	Risk: The regional CCA debate may be dominated by other groups.

6. ALIGNMENT WITH ADAPTION FUND RESULT FRAMEWORK

Groundwater resources in the Greater Mekong Subregion: Collaborative management to increase resilience

A collaboration of Cambodia, Lao PDR, Myanmar, Thailand and Vietnam to increase climate resilience in the greater Mekong Subregion through improved groundwater management and transboundary cooperation

Alignment of Project Objectives/Outcomes with AF Results Framework

Project Objective(s)[14]	Project Objective Indicator(s)	AF Fund Outcome	AF Fund Outcome Indicator	Grant Amount (USD-indicative)
GW resources management is improved, thus increasing the CCA and resilience of GMS countries to protect people, livelihoods and ecosystems.	Over 25 partnerships and active collaboration set up to support GW management capabilities that strengthen resilience and reduce detrimental climate change impacts. Over 50 regional experts support institutional capacity in 5 countries (male/female = 60/40%). Over 250 participants have increased awareness and skills on climate related impacts (male/female = 60/40%).	**Outcome 2:** Strengthened institutional capacity to reduce risks associated with climate-induced socioeconomic and environmental losses.	2.1.1. Number of staff trained to respond to, and mitigate impacts of, climate-related events (by gender). 2.1.2 Number of targeted institutions with increased capacity to minimize exposure to climate variability risks (by type, sector and scale).	2,500,000
GW users including women from different economic sectors in the GMS have access to requisite information and guidelines and thus participate in GW management.	In four pilot areas at least two different local GW users' groups are capacitated to use GW sustainably for adaptation and climate risk reduction measures. Higher management is also aware and involved.	**Outcome 3:** Strengthened awareness and ownership of adaptation and climate risk reduction processes at local level.	3.1. Percentage of targeted population aware of predicted adverse impacts of climate change, and of appropriate responses. 3.2. Percentage of targeted population applying appropriate adaptation responses.	2,400,000

[14] The AF used OECD/DAC terminology for its results framework. Project proponents may use different terminology but the overall principle should still apply

Project Outcome(s)	Project Outcome Indicator(s)	Fund Output	Fund Output Indicator	Grant Amount (USD-indicative)
A regional GMS approach to address challenges of climate change and resilience is created based on an information-based policy.	Greater GW management services made more responsive through improved resource assessments, management capability and information tools and human resources capacity in the sector. Greater water and specifically GW management services and supporting hard and soft infrastructure (policy and guidelines, database, monitoring systems, MAR systems) have been improved towards higher adaptive capacity.	**Outcome 4:** Increased adaptive capacity within relevant development sector services and infrastructure assets.	4.1. Responsiveness of development sector services to evolving needs from changing and variable climate. 4.1.1. Number and type of development sector services modified to respond to new conditions resulting from climate variability and change (by sector and scale).	1,000,000
Climate resilience and GW use in pilot areas is increased, and low income and other vulnerable groups' needs are prioritized.	Vulnerable people in four pilot areas and five countries will be able to rely on improved water management in support of livelihoods and other water needs.	**Outcome 6:** Diversified and strengthened livelihoods and sources of income for vulnerable people in targeted areas	6.1 Percentage of households and communities having more secure access to livelihood assets. 6.2. Percentage of targeted population with sustained climate-resilient alternative livelihoods.	1,000,000 800,000
A regionally coherent policy for sustainable GW management in support of CCA is adopted based on a level playing field of all users in the GMS.	Local interventions and guidelines (at least 3 in each pilot area) support resilience measures that are upscaled to national policies and guidelines. Regional (5 countries) and transboundary cooperation in pilots will generate at least 15 risk policies/guidelines.	**Outcome 7:** Improved policies and regulations that promote and enforce resilience measures.	7.1. Number of policies introduced or adjusted to address climate change risks (by sector).	500,000

Project Outcome(s)	Project Outcome Indicator(s)	Fund Output	Fund Output Indicator	Grant Amount (USD-indicative)
GMS stakeholders and communities capably use project tools on GW use for CCA and resilience.	Number of partnerships and active collaboration set up to support GW management capabilities that strengthen resilience and reduce detrimental climate change impacts.	**Outcome 1:** Reduced exposure to climate-related hazards and threats.	1.1 Number of projects/ programmes that conduct and update risk and vulnerability assessments by sector and scale.	800,000
	Over 50 regional experts support institutional capacity in 5 countries (male/female = 60/40%). Over 250 participants have increased awareness and skills on climate related impacts (male/female = 60/40%).	**Outcome 2:** Strengthened institutional capacity to reduce risks associated with climate-induced socioeconomic and environmental losses.	2.1.1. Number of staff trained to respond to, and mitigate impacts of, climate-related events (by gender). 2.1.2 Number of targeted institutions with increased capacity to minimize exposure to climate variability risks (by type, sector and scale).	

The result framework has been complemented with an overview of core impact indicators (SMART), using the core indicators tables prescribed by AF.

ADAPTATION FUND CORE IMPACT INDICATOR 1: NUMBER OF BENEFICIARIES

Date of Report	January 2017 (project approval stage)						
Project Title	Groundwater resources in the Greater Mekong Sub-region: Collaborative management to increase resilience						
Country	Cambodia, Lao PDR, Myanmar, Thailand, Vietnam						
Implementing Agency	UNESCO-Bangkok, with CCOP-TS Bangkok and supporting technical organisations						
Project Duration	4 years; 2018-2021						
AF Core Impact Indicator 1: "Number of Beneficiaries"							
	Baseline	Total for whole project	Target at project approval *(absolute number), per pilot area 1 to 4*				*1 = Lao PDR; 2=Cambodia-Vietnam Mekong Delta; 3=Cambodia NW-Thailand; 4 = Myanmar*
			1	*2*	*3*	*4*	
1. Direct beneficiaries supported by the project	0	2200	500	800	400	500	i.e. people trained or directly involved
1a. GW user groups	0	115	20	50	20	25	Average size of GW user group is 20 people
1b. GW management provincial – regional level		405	50	150	125	80	Participants from selected provinces/districts
1c. GW management & policy national level		230	30	100	60	40	Participants from national and subnational level
Clarification; 500 = No. of people participating in training and/or other awareness raising activities or otherwise directly involved in project activities. It is also reflecting the larger populations in for instance the upper Mekong Delta pilot areas. This is a very conservative estimate; the numbers will be adjusted on the basis of data collected during project Inception and more specific workplans.							
Female direct beneficiaries	0	880	200	320	160	200	Set at 40 % for the GW / water/ natural resources management sector
Youth direct beneficiaries (aged 15-24)	0	220	50	80	40	50	Set at 10 %, for instance through doing a school oriented awareness/training programme
2. Indirect beneficiaries supported by the project *(in thousands)*	0	1981	175	878	396	532	The communities of the above group (i.e. 5 trainees from 1 village or district of 5000 people, so here the No. of indirect beneficiaries is 5000 . Estimated as a reasonable % of the total population in the pilot area = 8-10 %. **The total is about two million.**
Female indirect beneficiaries	0	792	70	351	158	213	Set at 40 % of the total
Youth indirect beneficiaries (aged 15-24)	0	396	35	176	79	106	Set at 20 %, for instance through doing a school oriented awareness/training programme. At 20 % this means 1/100 = 1% of the total population

AF Core Impact Indicator 2: "Assets Produced, Developed, Improved, or Strengthened"

Date of Report	January 2017 (project approval stage)						
Project Title	Groundwater resources in the Greater Mekong Sub-region: Collaborative management to increase resilience						
Country	Cambodia, Lao PDR, Myanmar, Thailand, Vietnam						
Implementing Agency	UNESCO-Bangkok, with CCOP-TS Bangkok and supporting technical organisations						
Project Duration	4 years; 2018-2021						
AF Core Impact Indicator 2: "Assets Produced, Developed, Improved, or Strengthened"							
	Baseline	Total for whole project	Target at project approval *(absolute number), per pilot area 1 to 4* *1*	*2*	*3*	*4*	*1 = Lao PDR; 2=Cambodia-Vietnam Mekong Delta; 3=Cambodia NW-Thailand; 4 = Myanmar*
Sector: Cross-sectoral: Water Management, Food Security, Rural Development, Agriculture, Health			Water supply based on GW resources touches upon all these sectors and it is the explicit aim to develop and apply GW-based resilience measures for different sectoral stakeholders.				
Targeted Services / Assets 1) Development Services (developed/improved)	0	8	8	8	8	8	**Development services;** support for technical and managerial skills and regulatory framework for GW management, improved capacity of regional and local monitoring and oversight, increased capacity of GW use-related extension services.
2) Physical assets/infrastructure *(produced/improved/strengthened)*	0	5	5	5	5	5	**Physical assets/infrastructure:** Physical infrastructure to increase resilience and adapt to climate change including: GW exploitation and recharge systems, resource use monitoring networks and necessary data management and processing systems, water harvesting and conservation systems. The number of individual (small) wells could be significantly higher.
- *Well systems*	0	2250	150	1200	400	500	
- *GW recharge systems*	0	90	10	30	30	20	
- *Monitoring systems*	0	18	2	6	6	4	
Changes in asset status - Development Services; (*Qualit.)*	0	3-5	3-5	3-5	3-5	3-5	Services and Assets change of status 5: Fully improved, 4: Mostly Improved or 3: Moderately improved
- Training, information and awareness services (Quant.)	0	24	3	8	8	5	

AF Core Impact Indicator 3: "Natural Assets Protected or Rehabilitated"

Date of Report	January 2017 (project approval stage)
Project Title	Groundwater resources in the Greater Mekong Sub-region: Collaborative management to increase resilience
Country	Cambodia, Lao PDR, Myanmar, Thailand, Vietnam
Implementing Agency	UNESCO-Bangkok, with CCOP-TS Bangkok and supporting technical organisations
Project Duration	4 years; 2018-2021

AF Core Impact Indicator 3: "Natural Assets Protected or Rehabilitated"

	Baseline	Total for whole project	Target at project approval *(absolute number), per pilot area 1 to 4* *1*	*2*	*3*	*4*	*1 = Lao PDR; 2=Cambodia-Vietnam Mekong Delta; 3=Cambodia NW-Thailand; 4 = Myanmar*
Natural Asset or Ecosystem - Improved water retention areas - Aquifer recharge areas	0 0	-	-	-	-	-	The number of designated water retention and aquifer recharge areas is indicated below; size in ha cannot yet be specified, the given number is indicative
Change in state *Effectiveness of protection/ rehabilitation - Scale (1-5*	0	3-5	3-5	3-5	3-5	3-5	5: Fully improved, 4: Mostly Improved or 3: Moderately improved
Total number of natural assets or ecosystems protected/ rehabilitated	0 0	18 21	3 4	4 6	8 8	3 3	Natural areas and ecosystems elements designated as recharge areas

The project does not envisage generating results and impact on the other core indicators (viz. http://www.adaptationfund.org/wpcontent/uploads/2015/01/ AF%20Core%20Indicator%20 Methodologies.pdf)

7. Project budget

This technical project proposal is accompanied by a comprehensive budget proposal, following Adaptation Fund guidelines. The budget is available in **Annex II** (Excel format). Soft copies can be provided on request.

Project budgets (Excel sheets annexed)
Sheet 1: Summary project budget
Sheet 2: Breakdown of the project execution costs (CCOP-TS)
Sheet 3: Implementing Entity (MIE) management fee (UNESCO)
Sheet 4: Budget disbursement schedule with time-bound milestones.
Sheet 5: Detailed project budget, Excel format (Annex)

In this main document we present summaries of the different budget sheets

Sheet 1: Summary project budget

No.	Description	Budget (US $)
1.	Programmatic costs, Component 1 - 5	4,200,000
2.	Execution Costs (CCOP-TS) @ 8.5 %	357,000
3.	Subtotal	4,557,000
4.	Management fee MIE @ 7.5 % of Subtotal	341,775
5.	**Total Project budget**	**4,898,775**

Sheet 2: Breakdown of the Project Execution Costs (CCOP-TS)

No.	Description	Budget (US $)
1.	Project Coordinating Technical Advisor	180,000
2.	CCOP-TS Support staff	90,000
3.	Operational costs	40,000
4.	Project related regional travel	26,000
5.	External services (website, accountant)	21,000
	Total	**357,000**

Sheet 3: Budget for the Implementing Entity (MIE, UNESCO) management fee.

No.	Description	Budget (US $)
1.	General programme implementation support	224,000
2.	Finance, budget and treasury support	46,000
3.	Reporting to Adaptation Fund, M&E	210,000
4.	Project related regional travel	25,687
5.	Operational costs, publications costs	26,866
6.	External services (procurement, accountant)	21,222
	Total	**592,775**

Sheet 4: Budget disbursement schedule with time-bound milestones.

Payment	**Upon Agreement signature**		**Year 1**		**Year 2**		**Year 3**		**Year 4**		**Total %**	**Total Amount**
											(US $)	
Scheduled Date	01-12-17		01-12-18		01-03-19		01-03-20		01-03-21			
Project Funds, incl. Exec. costs	10.97%	500,000	*11.17%*	509,159	*30.02%*	1,367,968	*30.43%*	1,386,630	*17.41%*	793,244	*100.00%*	**4,557,000**
Implementing Entity Fee	10.24%	35,000	*11.90%*	40,687	*30.02%*	102,598	*30.43%*	103,997	*17.41%*	59,493	*100.00%*	**341,775**
Total		**$ 535,000.00**		**$549,845.39**		**$1,470,565.60**		**$1,490,627.25**		**$852,736.76**		**$ 4,898,775.00**

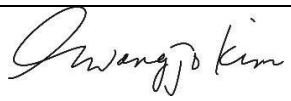
[a/]Use projected start date to approximate first year disbursement
[b/]Subsequent dates will follow the year anniversary of project start
[c/]Add columns for years as needed

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

A. Record of endorsement on behalf of the government:

Cambodia: Mr. Tin Ponlok, Secretary General, NCSD/Ministry of Environment	Date: Jun, 30, 2017
Lao PDR: Mr. Syamphone Sengchandala Department of Disaster Management and Climate Change (DDMCC), Ministry of Natural Resources and Environment	Date: Jun, 15, 2017
Myanmar: H.E Ohn Winn U Win Tun, Union Minister, Ministry of Natural Resources and Environmental Conservation and Forestry and Chairman of the Environmental Conservation Committee	Date: *Awaiting for letter*
Thailand: Mr. Kasemsun Chinnavaso, Permanent Secretary, Ministry of Natural Resources and Environment	Date: Jun, 28, 2017
Viet Nam: Dr. Tran Hong Ha, Minister, Ministry of Natural Resources and Environment	Date: July, 14, 2017

B. Implementing Entity certification

I certify that this proposal has been prepared in accordance with guidelines provided by the Adaptation Fund Board, and prevailing National Development and Adaptation Plans (Lao PDR and Vietnam) and subject to the approval by the Adaptation Fund Board, commit to implementing the project/programme in compliance with the Environmental and Social Policy of the Adaptation Fund and on the understanding that the Implementing Entity will be fully (legally and financially) responsible for the implementation of this project/programme.	
Name and Signature  Implementing Entity Coordinator: **GWANG-JO KIM** DIRECTOR UNESCO BANGKOK	
Date: **1 August 2017**	Tel. and email:+66-3918474; gj.kim@unesco.org
Project Contact Person: **RAMASAMY JAYAKUMAR**	
Tel. and Email: +66-2-3910577 X 343 ; r.jayakumar@unesco.org	

Annexes

Annex I: Comprehensive characterization of the proposed four pilot areas

Annex II: Detailed budget and budget Excel sheets