Annex 18(b): Lessons Learned from Baseline Projects

1) Applying Best Practices and Lessons Learned to Project Design and Implementation - ECOSwat and TGCP-Water

2) Lesson Summary Report: “Bang Rakam Model 60 Project”

Applying Best Practices and Lessons Learned to Project Design and Implementation - ECOSwat and TGCP-Water

This document presents the history of EbA policies, mandates and implementation in Thailand, which have been applied to the design of the EbA activity of the GCF proposal, *Enhancing climate resilience in Thailand through effective water management and sustainable agriculture.* The first part provides background on the Thai government's efforts to include the EbA approach into its water management system through Ecosystem-based Adaptation in Watersheds (ECOSWat) project and its main results and achievements, as well as gaps and recommendations. The second part introduces the water component of the Thai German Climate Programme (TGCP-Water) which applied lessons from ECOSWat to improve the enabling environment for EbA measures in the Thai water sector. This section will outline the approach of TGCP-Water with its objective to enhance the national framework conditions for climate-sensitive IWRM and Ecosystem-based Adaptation (EbA) solutions to prevent and reduce the impacts of climate change and water-related disasters at national and river-basin levels. The third part addresses requirements under the new Thai Water Act on river basin management and how TGCP-Water will support operationalization of the Act within river basin master planning processes. It will explain how the products and processes supported by TGCP-Water to improve climate resilient river basin master planning in Thailand by introducing a robust methodology for Climate Risk Vulnerability Assessment (CRVA) and identification of suitable EbA measures will supplement Thailand's GCF funding proposal.

Part I: Ecosystem-based Adaptation in Watersheds (ECOSWat) and its achievements

Due to climate change impact, Thailand is facing the increasing numbers of more extreme events from increasing frequency as well as intensity floods and droughts. In order to reduce these negative impacts, while continuing its sustainable development, Thailand must adapt to and mitigate climate change and variability. The German Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety (BMU) supports the government of Thailand in its efforts to include the EbA approach into its water management system through the project *Improved Management of Extreme Events through Ecosystem-based Adaptation in Watersheds* (ECOSWat). The project started in 2013 with the 1st funding phase until mid-2016 and the 2nd phase until December 2017. Four main expected outputs were.

1) Water management institutions in the Chi and Tha Di catchment areas are using an information system for the development of the water management plans, which integrates data from DWR, RID, the respective River Basin Committee as well as of the local universities.
2) At least one ecosystem-based adaptation measure in the field of drought and flood prevention in the Chi and Tha Di catchment areas is implemented respectively.
3) Thailand's national adaptation strategy for the water sector includes ecosystem-based watershed management measures in the field of drought- and flood-prevention. Experiences from the pilot measures are integrated into national adaptation strategies.

4) DWR's and RID's responsible employees at national level are trained in the design of EbA measures.

After collaboration with partners for implementation of the ECOSWat, main results achieved by the project were:

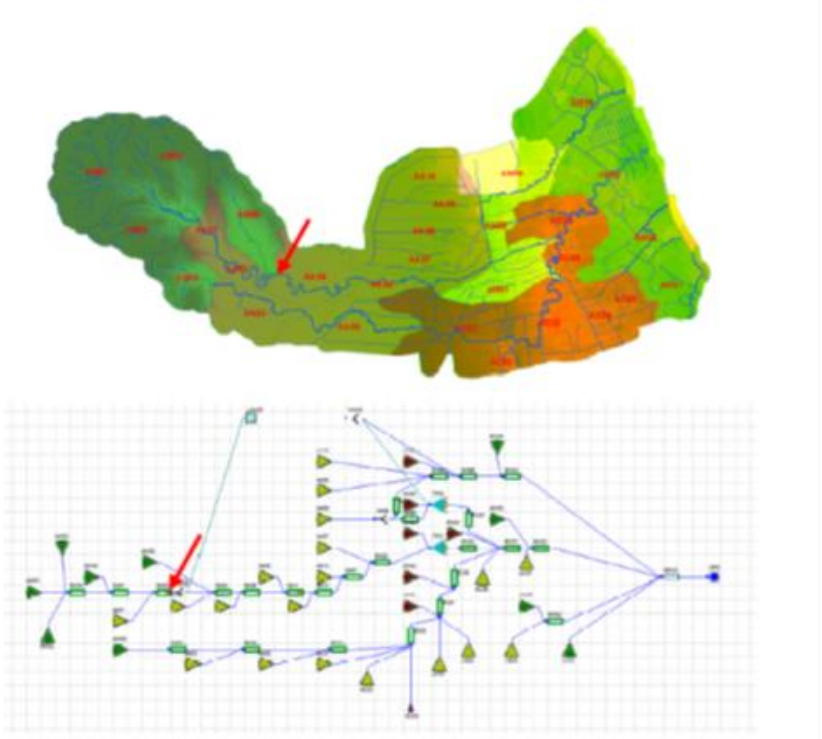
Vulnerability assessment for the catchment areas of Huai Sai Bat (Khon Kane province) and Tha Di (Nakhon Sithammarat province) was carried out using *Global International Water Assessment Methodology (GIWA) and Hydropower Sustainability Assessment Protocol (HSAP).* The vulnerability study was carried out based on cause-effect relationships identified and verified in different stages as following.

a. Geographical scaling to define the geographic boundaries of the pilot areas to be analysed,
b. Scoping to address procedure the critical major concerns and issues by assessing their environmental and socio-economic impacts,
c. Causal chain analysis to traces the root causative factors behind the selected concerns and issues and is conducted to serve as the foundation of the selection of policy options,
d. Policy option analysis indicates potential policy interventions based on the identification of the root causes conducted in the Causal Chain Analysis, and
e. Detailed Assessment consists of applying different types of models, results from these models constitute the main source complemented by literature that is used to obtain and verify model parameters. Noted that the assessment undertook three modelling approaches; *hydrological modelling (using TalsimNG in Tha Di and TalsimNG in comparison with SWAT in Huai Sai Bat), Erosion and sedimentation modelling (HEC-HMS), and Water quality modelling (GISMO)* (Figure 1).

Vulnerability assessment for the catchment areas of Huai Sai Bat (Khon Kaen province) and Tha Di (Nakhon Sithammarat province) was carried out using Global International Water Assessment Methodology (GIWA) and Hydropower Sustainability Assessment Protocol (HSAP). The assessment undertook three modelling approaches: hydrological modelling (using TalsimNG in Tha Di and TalsimNG in comparison with SWAT in Huai Sai Bat), Erosion and sedimentation modelling (HEC-HMS), and Water quality modelling (GISMO).

As a result, the most important vulnerabilities of each catchment areas were explained based on selected approach and protocol. The vulnerability assessment report also suggested *Integrated water resources management associated with ecosystem-based measures for Tha Di and Huai Sai Bat.*

Figure 1 Flow network of hydrological model of Tha Di river basin

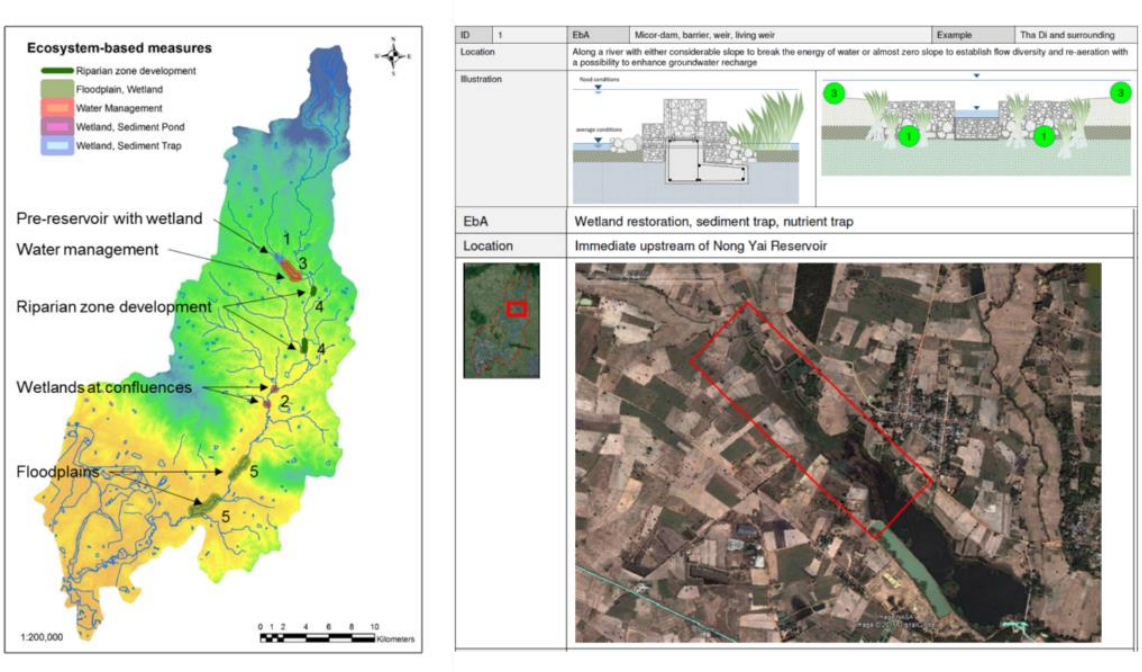


Pre-Selection of Ecosystem-based Measures in Tha Di and Huai Sai Bat. A careful preselection of potential measures and locations are based on results of the vulnerability assessment (VA) and public participation. The effect matrix EbA and fact-sheets for all potential EbA were prepared for planning process complemented with a possible location to implement identified potential EbA option.

Figure 2 EbA - effects matrix

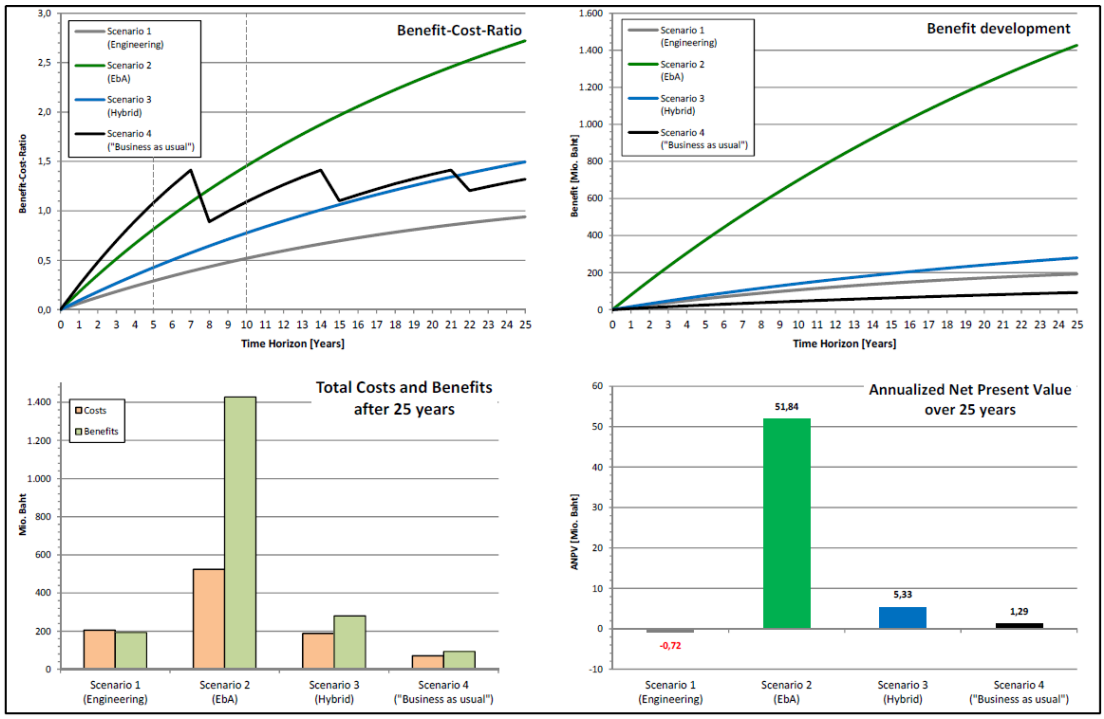
	Sedimentation	Flood	Supply safety	Water quality	Biodiversity
Weir	++	o	+	-	o
Sediment pond	++	+	o	-	o
River channel modification	o	o	+	+	+
Riparian zone creation	+	o	o	+	+
Floodplain + wetland dev.	+	+	+	+	++
Water spreading weir	-	+	+	o	o
Constructed wetland	o	o	o	+	o
Bank erosion prevention	+	o	o	o	+
Water management	+*	+*	+*	+*	+*
River bed enhancement	o	o	o	+	+
Constructed Wetland	o	o	o	++	(+)

Figure 3 Potential ecosystem-based measures in Huai Sai Bat



Economic evaluation of EbA measures. To conduct an economic evaluation of EbA measures within the Huai Sai Bat and Tha Di river basin, the economic evaluation is based on a *Cost-Benefit-Analysis (CBA)* of the proposed individual measures and of different scenarios representing varying combinations of the potential EbA measures identified in the report of Pre-Selection of Ecosystem-based Measures. Taking example from Huai Sai Bat case study, four scenarios were developed to rank the identified potential measures in terms of their combined efficiency to counteract the water scarcity problem in the Huai Sai Bat Basin : Scenario 1 (“Engineering”) consists only of dredging of the Nong Yai reservoir, Scenario 2 (“EbA”) includes all EbA measures but no engineering measures, and Scenario 3 (“Hybrid”) combines a reduced set of EbA measures with a dredging alternative of the reservoir. Scenario 4 is considered as the baseline scenario with ongoing regular dredging of the Nong Yai reservoir (“Business as usual”) and no EbA measure. The study result showed that Scenario 3 (“Hybrid”) with its measure combination that increases and secures the storage capacity of the Nong Yai reservoir appears to be the most promising alternative to safeguard the water security in the Huai Sai Bat river basin from considering total costs, BCR and the effectivity to secure high water storage capacity during the dry season.

Figure 4 Final results of economic evaluation of the four scenarios



DWR's and RID's responsible employees at national level are trained in the design of EbA measures. EbA training modules were elaborated by an international consultant and a Training of Trainers of GIZ project staff took place to help further diffusion. Trainings were then delivered at the national and regional level to main partners, identified with the help of DWR. Training module topics included *causes and effects of climate change, scoping exercise, assess vulnerability and climate risk, identify adaptation options, select adaptation measures, analyze ecosystem functionality for EbA and develop next steps for an action plan.*

Implementation of the EbA on the pilot site after the ECOSWat. DWR has initiated and conducted feasibility and geographical surveys to implement the selected EbA measures on their own even after the project ended for some sites, which contributes to show some sense of integration within their planning. Selected EbA measures were implemented with modification on design due to limitation on site and regulations from the Thai Budget Bureau (two in Huai Sai Bat and one in Tha Di) as showing in Figure 5.

Figure 5 Micro dam in Haui Sai Bat (left) and sediment trap wetland in Thai Di (right) designed and constructed by DWR

Room for improvement from ECOSWat and recommendation for new TGCP-Water. One of the key challenges found from ECOSWat was lacking participation, which partially led to a lack of ownership and related to unclear roles and responsibility of river basin committee in Thailand at that state. Lack of participation seems to be caused by a combination of top-down approach with technical analysis, lack of clarity on value added for the partner, and partner's mandate (DWR – the main project partner – does not have the mandate to build these measures).

At the regional level, River Basin Committees (RBC) was established by the government to help review activities and propose measures / projects and organize public hearings for the 25 river basins in Thailand. However, it was identified that RBCs as weak inactive structures lacking their own budget and constituting an additional workload for its members. DWR assumes the role of the secretariat of RBCs. RBC did however have clear roles and mandate after the Thai Water Act was adopted in 2018. To ensure sustainability of the new TGCP-Water component, it was recommended to focus specifically on the technical, on the institutional and on the operational level. Key recommendations are but not limited to:

- Following-up with the training programme – strengthening capacity building
- Developing EbA guidelines focusing on methodologies and guidelines used by agencies will help ensure uptake and sustainability
- Making sure the project is aligned with national priorities and partners' mandates and frame it as a "value-added"
- Explicitly focusing on sustainability of the project from the start by for example having an exit strategy. Engaging other stakeholders especially on the "implementation" side including public & private stakeholders

Part II: Thai German Climate Programme- water (TGCP-Water) objective, expected output to supplement the GCF proposal and current status

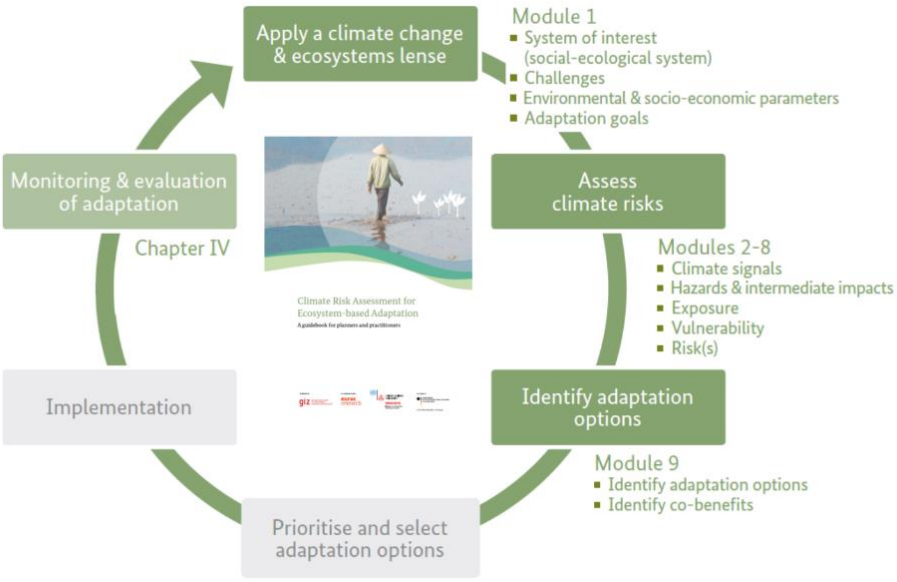
After completion of ECOSWat project, TGCP-Water was initiated as part of the Thai-German Climate Programme (TGCP), which is financed by the International Climate Initiative (IKI) of the German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU) for the period of January 2018 - December 2021. TGCP-Water is guided by Thailand's Water Resources Act (2018), the 20-year National Water Resources Management Master Plan (2018–2037) and water sector related climate change policies and strategies, namely Thailand's National Adaptation Plan (NAP) and the Thai NDC under the Paris Agreement. Lead partner is the Office of the National Water Resources (ONWR), together with other key partners, namely Department of Water Resources (DWR), Department of Public Works & Town and Country Planning (DPT), and Royal Irrigation Department (RID).

TGCP-Water aims to enhance the national framework conditions for climate-sensitive IWRM and Ecosystem-based Adaptation (EbA) solutions to prevent and reduce the impacts of climate change and water-related disasters at national and river-basin levels. Yom river basin (similar area to the GCF proposal) and Sakaekrang river basin were selected as a pilot area to illustrate the activities and output of the Programme. Under Sub-national Implementation (river basin level) and EbA Monitoring and Evaluation (M&E) component, the Programme is in the process of developing several guidebooks/ guidelines and in parallel with capacity building programme to ensure sustainability of the project from the start.

National guideline for climate-sensitive River Basin Master Plan (RBMP) process - TGCP-Water in close cooperation with ONWR is to develop a national guideline for the development of climate-sensitive River Basin Master Plans (RBMP) guiding RBCs and other related stakeholders in the systematic integration of climate risk information as well as prioritisation and selection of (Ecosystem-based) - adaptation actions. This is to ensure the proposed measures in the basins are sufficient to achieve the national water resources management strategy objectives under potential future climate change scenarios.

Climate Risk Vulnerability Assessment (CRVA) guidebook - TGCP-Water is collaborating with Hydro – Informatics Institute (HII) Thailand to develop a guidebook for Climate Risk and Vulnerability Assessment (CRVA) and Cause-Impact Chains for Risk-informed and Climate-sensitive River Basin Master Plans. Methodology to develop this guidebook is based on Climate Risk Assessment for Ecosystem-based Adaptation – A guidebook for planners and practitioners. In this study, SSP245 and SSP585 scenarios will be used for future hazard analysis and a bias correction technique, namely the gamma transformation and linear scaling technique, will be applied for removing the biases of GCMs before studying the impact of climate change in river basin and regional scales. Hydrological model will be selected to fit with purpose of the project. As a result, risk map will be developed based on public participation approach to identify casual chain and propose EbA measure in the pilot areas to be included in a river basin master plan for budgeting and implementation according to the Water Act.

Figure 6 EbA Mainstreaming cycle

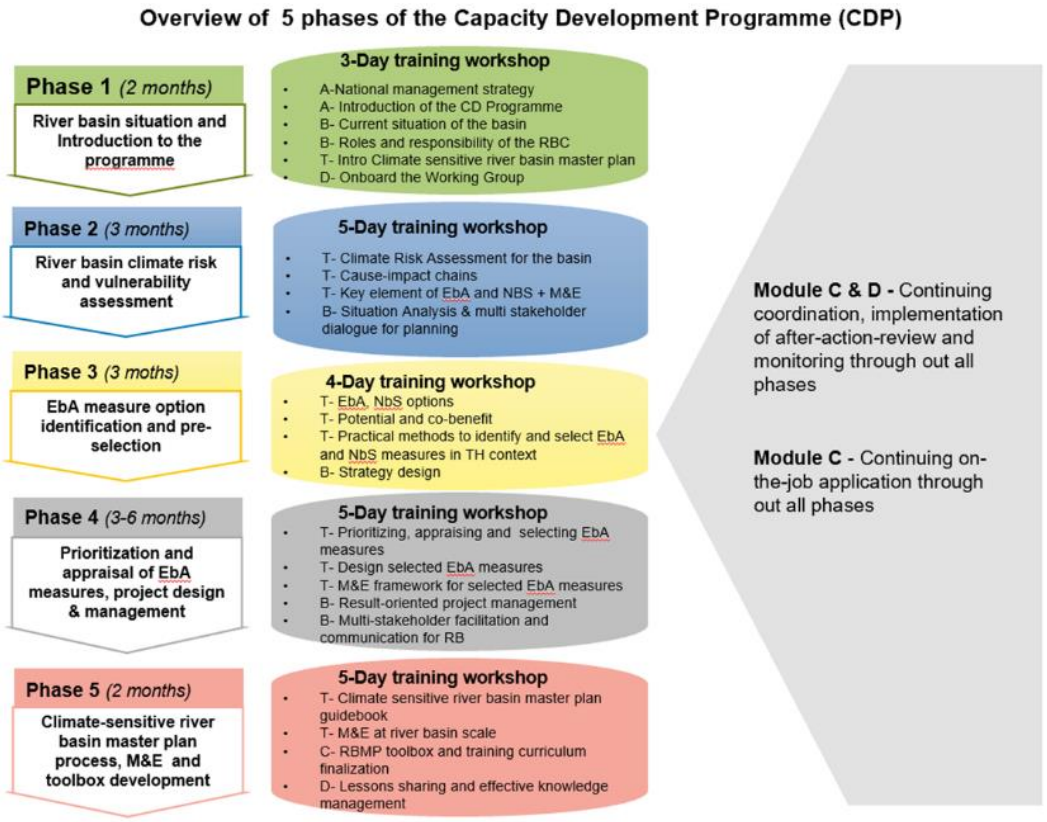


EbA guidebook - An EbA Guidebook is being developed specifically to address EbA measures for the Thai water context, as well as capacity-building measures including practical on-the-job trainings to jointly identify and select appropriate EbA measures that will be carefully designed and developed for later implementation in the pilot basins based on a result from CRVA. TGCP-Water is collaborating with IUCN Thailand to tailor the EbA Guidebook to the Thai water sector which will provide practitioners with the steps to integrate EbA into river basin planning processes. The Guidebook will demonstrate the relevance of the EbA approach, and act as a reference tool for decision makers, supporting decision making and monitoring of EbA measures in the two pilot basins.

EbA Code of Practice (CoP) Compendium for the Thai Water Sector – the document is to be developed to guide and support practitioners in the application of specific EbA design principles and guide an EbA project implementation. It is to provide a positive user experience and meet and exceed user needs.

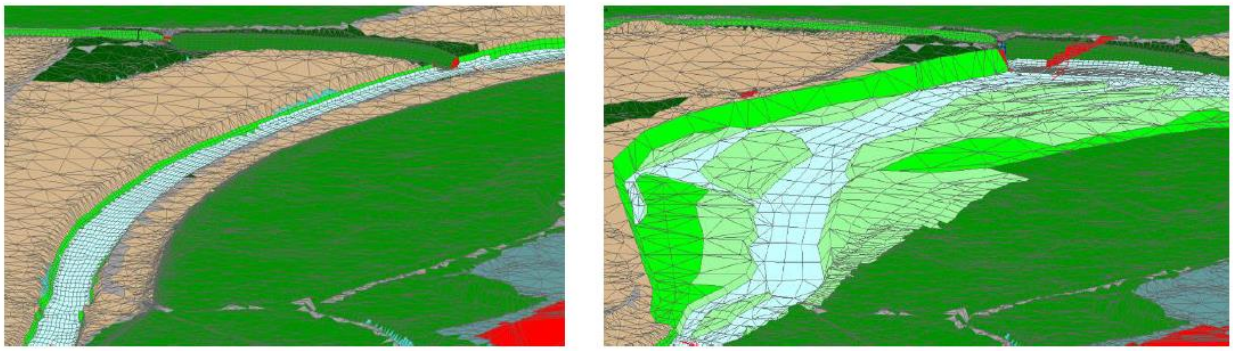
Capacity Development Programme (CDP) - This capacity development programme aims to strengthen institutional capacity of the key stakeholders in river basin management to develop "climate sensitive IWRM River Basin Master Plan (RBMP)," focusing in the two pilot areas of Yom and Sakae Krang river basins. The programme concept is developed based on the needs of Yom and Sakae Krang river basins collected through consultation and workshops at each river basin. At the end of the programme, it is expected that the participants will have strengthened their technical know-how on climate-sensitive IWRM and ecosystem-based solutions for climate change adaptation including competencies in river basin management and planning process facilitation with participatory approach. Each river basin will develop draft project proposals that include ecosystem-based adaptation measures to tackle adverse climate change risk in their river basins by applying results-oriented participatory approach. The CDP will comprise of 5 phases as illustrated in Figure 7.

Figure 7 The training content structure



Technical guidance on the development and application of Oxbow lakes and To support the use of ecosystem services for adaptation to climate change at river basin scale, the Yom river oxbow lake feasibility study will be conducted to look for the idea to reduce flood and drought risks through oxbow lakes ecosystems service. Up to 22 Oxbow lakes are to be assessed, pre-selected and ranked according to technical aspects like expected effects on flood levels, groundwater recharge and retention capacities, prerequisites for implementation, cost-benefits and maintenance considerations, but also in terms of participation, technical understanding and acceptance by local communities and institutional stakeholders. Result from oxbow lakes feasibility study will be used a.) for the design and preparations of up to two “Oxbow lake” EbA pilot projects to be implemented under the Yom River Basin Master Plan (RBMP) and b.) as a specific input to the development of an “Oxbow lake case study” for the EbA CoP to support the sound technical design and budgeting of similar EbA measures. 2D Hydrological model will be applied to demonstrate effects and facilitate design (with and without oxbow lake). In addition, the hydraulic analysis is key to distinguish different ecological zones and land use management strategies under normal, low and high flow conditions.

Figure 8 Example of 2D hydrological modeling



Evaluation of EbA implemented from ECOSWat project – EbA measures were implemented by the DWR in Haui Sai Bat and Tha Di catchment area. An evaluation of those EbA measures will be conducted to evaluate efficiency of the interventions covering topics of design principles and safety, Socio-economic (stakeholder opinion and experience, ownership, services used, labor force, co-benefits), economics (investment costs, benefits, operation costs; Net Present Values and Internal Rate of Returns), situation analysis before and after the implementation, required hydrological, hydraulic and bioengineering assessments, SWOT analysis and others. The results of the evaluation will also be integrated in the EbA CoP development process.

A joint research partnership between ONWR and selected universities - the collaboration has been set up to support the development of a digital solution-based Monitoring and Evaluation (M&E) methodology to assess the impacts and benefits of EbA measures and provide scientific evidence on the important role ecosystems can play for climate resilient river basins. The EbA M&E Methodology for flood plain in Yom river basin is currently developed using Theory of Change (ToC). It was mentioned in the previous clarification with CNET that *"SWAT-MODFLOW Modeling of Hydraulic Interactions between Wetlands, Rivers, and Aquifers, Stable Isotope Analysis as well as GRACE & GRACE-FO in Combination with GLDAS-LSM for Terrestrial Water Storage (TWS) and Groundwater Storage (GWS) Change Estimation are to be applied in the flood plain pilot M&E project".*

From the expected key outputs and process under TGCP-Water mentioned above will clearly support Activity 2.2. Complementing of grey infrastructure with EbA measures and integration of EbA approaches into water management policy and planning under the GCF proposal. Implementation of TGCP-Water can be seen as establishing needed inputs and tools to implement the Activity 2.2 of the GCF proposal. The TGCP-Water aims to introduce the CRVA and EbA measure to implement through learning by doing approach and supplement the new Thai Water Act which require to have river basin master plan approved by the river basin committee through participatory approach before proposed to the National River Committee for budget approval and implementation.

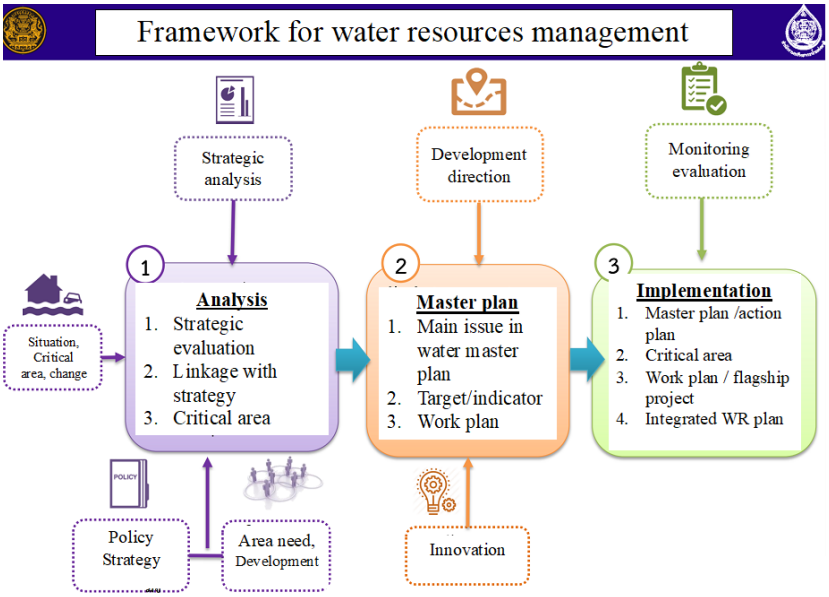
Part III: Requirements under the new Thai Water Resource Act on river basin management and river basin master plan

Water Resource Act, B.E. 2561 (2018) is bestowed by His Majesty King Maha Vajiralongkorn Bodindradebayavarangkun on 25th December B.E. 2561. This Act lies in putting forth efficiency and effectiveness of the administration of water resources in respect of the allocation, use, development, management, maintenance, rehabilitation and conservation thereof as well as rights in water, thereby benefiting the provision of public utility services and other public interests.

Under section 35 of the Water Resource Act B.E. 2561, a river basin committee has an important role for not only river basin level, but also national body. A river basin committee has the duties and powers in connection with water resources administration in the boundary of the river basin and shall also have the duties and powers including to prepare a master plan on the use, development, management, maintenance, rehabilitation and conservation of water resources in the boundary of the river basin and submit to the the National Water Resources Committee (NWRC) for approval.

Under Part II: Prevention and resolution of water drought and Part III: Prevention and resolution of flood, it was mentioned that in preparing the plan on the prevention and resolution of water drought/ flood, there shall be the integration with the national plan on the prevention and mitigation of public disasters and other relevant plans and also the *hearing of opinions of State agencies as well as local government organisations concerned and people in the areas of the drainage basin, as may be necessary.* Prevention and resolution of flood and drought will be part of River Basin Master Plan to be approved by a river basin committee. Office of National Water Resources (ONWR) presents the framework for water resources management in three main steps; situation analysis, master plan setting and project implementation. The step and detail of water resources management is presented in Figure 9.

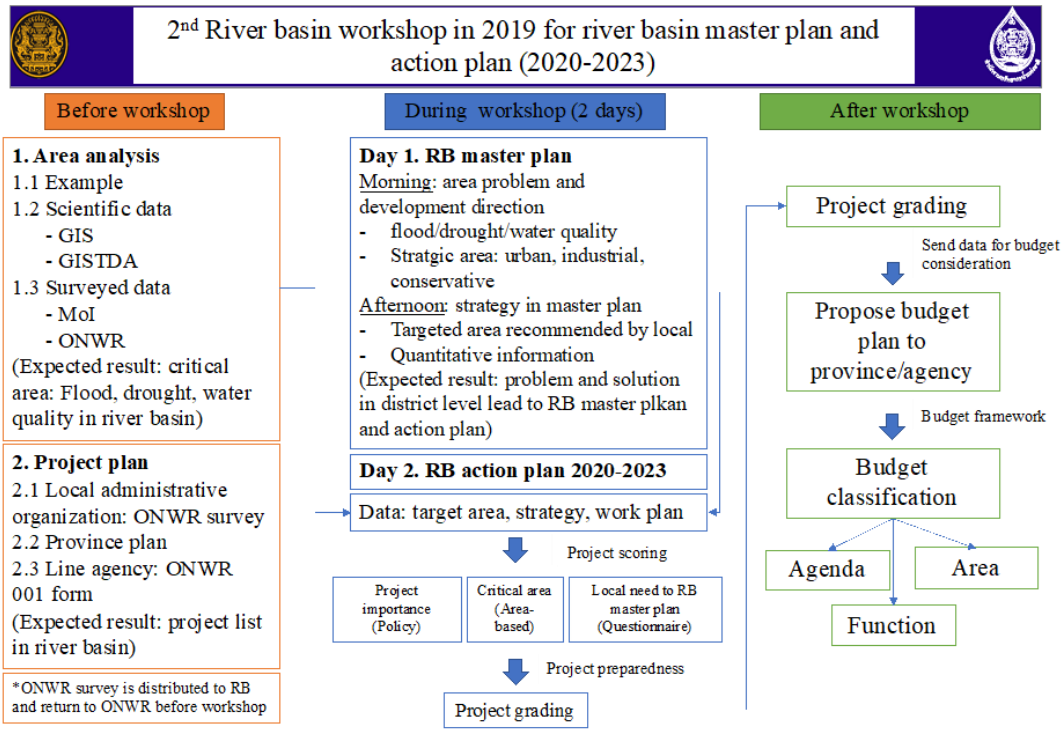
Figure 9 Framework for water resources management



In 2019, ONWR set up the river basin workshop process to develop a river basin master plan and action plan for 2020-2023. The workshop tool place in 2 days, and the participants as representative from

the river basin needed to prepare their data before entering this workshop. First, member analyzes their critical area by scientific data (GIS data and map) and surveyed data from MoI and ONWR. Issues of flood, drought, water quality are illustrated in river basin. Project plans of local administrative organization, province and line agency are collected as a project list in river basin. Second, river basin master plan and action plan were developed during 2-day workshop. The first day workshop focused in master plan development. Water-related problem and development direction were discussed in morning section. The discussion result was used to design the strategy in master plan to address the identified issue. The second day was for project prioritization by scoring process. Information of targeted area, project plan, strategy and project preparedness were utilized to set the priority in order to propose the project to budgeting process. Finally, after workshop, prioritized projects were proposed to province/agency and budget allocation process was classified by agenda, area and function. The details can be shown in Figure 10.

Figure 10 Process for river basin master plan and action plan development in 2-days workshop



On 2 February 2021, the NWRC announced a new regulation to promote and support the private sector, people and concerned communities to take part in water resource management. Under this regulation, it was stated in session 4 that 'In any area of water resource management initiatives, information must be provided sufficiently to the private sector, relevant people and communities to create awareness that will be useful in participating in the management of water resources in the area'.

Therefore, it was guided by the Water Act, related decrees, and sub-decree that proposed measures for water management in any basin must be included in the river basin mater plan through participatory approach and documentation process through river basin committee for budget approval and implementation. However, it was noted that the issue of climate change and climate risk in long term is not mainstreamed to present river basin master plan process. This is one of the main gaps of river basin management in Thailand which TGCP-Water sees that Climate risk should be

mainstreamed to existing master plan with the framework of adaptive management and ecosystem-based adaptation which are mainly applied to climate change impact for water sector in Thailand.
In summary, products and outputs from TGCP-Water will be utilized to support Activity 2.2 under the GCF proposal through a participatory approach and guided by the Water Act. Particularly after completion of the CRVA and identification and feasibility study of EbA measures in Yom basin (expected to be included in the action plan of Yom river basin master plan) is to be used as a rational to identify EbA measure in GCF proposal study area. During implementation of the Water component of the Thai German Climate Programme (TGCP-Water, 2018-2021), hydrological impact assessments will be applied for evaluation the EbA measures implemented by the Department of Water Resources in Huai Sai Bat (Khon Kaen province) and Tha Di (Nakhon Sithammarat province). In addition, 2D Hydrological model will be applied to demonstrate effects and facilitate design for a feasibility study of an oxbow lake in Yom river basin (modelling impacts with and without oxbow lake).

Other TGCP-Water outputs, such as Climate Risk Vulnerability Assessment (CRVA) guidebook, EbA guidebook and Code of Practice, M&E methodology for the flood plain in Yom river basin are being developed to support climate-sensitive River Basin Master Planning (RBMP) by following guiding principle from the Water Act B.E.2561 and relevant decrees and sub-decrees. It is noted that the Water Act requires a river basin committee to develop and approve a river basin master plan before submission to the National Water Resources Committee (NWRC) for budget approval, and such a plan must go through process and documentation as suggested by the Office of National Water Resources (ONWR) including public participation under a new regulation (4 February 2021) from NWRC to promote and support the private sector, people and concerned communities to take part in water resource management.

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Lesson Summary Report
"Bang Rakam Model 60 Project"
(translated report)

Lesson Summary Report

"Bang Rakam Model 60 Project"

Monday, 11 September 2017

Convention Hall, Military Circle No. 39, King Naresuan the Great Army Base,

Muang District, Phitsanulok

Royal Irrigation Department, Ministry of Agriculture and Cooperatives

Chapter 1

Background of Lessons Learned

1.1 Background of Lessons Learned

The Peace and Order Maintaining Force of the Third Army made a memorandum of understanding titled "Water Management in the Yom–Nan River Basins and Bang Rakam Model 60" with the Royal Irrigation Department encompassing Phitsanulok, Sukhothai, Uttaradit and Phichit in the management of river basin water, also known as the "Bang Rakam Model 60 Project." Subsequently, water was released to farmers in low basin areas in Phitsanulok and Sukhothai for rice farming in 2017 on 1 April 2017. Farmers were able to harvest their rice produce before the arrival of the monsoon in September 2017. As a result of the aforementioned undertaking, the 39th Military Circle by the Peace and Order Maintaining Force of Phitsanulok and the provincial administration of Phitsanulok view that the Bang Rakam Model 60 Project as beneficial to cultivation in low basin areas, which suffer from the problem of recurring floods every year. The province of Phitsanulok and adjacent provinces were able to successfully achieve true implementation. As the Royal Irrigation Department has the Public Participation Promotion Division, the Office of Water Management and Hydrology and the Office of Project Management, which have expertise in water management and lessons learned, the Royal Irrigation Department was requested to provide an extraction of lessons from the Bang Rakam Model 60 Project with five objectives involved, namely, water management, society, environment, economy and public relations.

-Royal Garuda Emblem-

No. Kor. Sor. Chor. (Ror. Sor.) 3.1/696

Peace and Order Maintaining Force Headquarters, Phitsanulok, King Naresuan the Great Army Base, Muang District, Phitsanulok 65000

31 August 2017

RE: Request for Extraction of Lessons Learned, "Bang Rakam Model 60 Project"

ATTN: Director-General, Royal Irrigation Department

REF: Memorandum of Understanding on "Water Management in the Yom–Nan River Basins and Bang Rakam Model 60," dated 22 February 2017

Whereas the Third Army/Peace and Order Maintaining Force of the Third Army's has drafted a memorandum of understanding on "Water Management in the Yom–Nan River Basins and Bang Rakam Model 60" with the Royal Irrigation Department encompassing Phitsanulok, Sukhothai, Uttaradit and Phichit in basin water management, also known as the "Bang Rakam Model 60 Project", water was released to farmers in low basin areas in Phitsanulok and Sukhothai for rice farming on 1 April 2017. At present, the farmers have successfully harvested their rice crops before the arrival of the monsoon in September 2017.

As a result of the aforementioned undertaking, the 39th Military Circle/Peace and Order Maintaining Force of Phitsanulok and the provincial administration of Phitsanulok view the Bang Rakam Model 60 Project as beneficial for cultivation in low basins faced with the problem of recurring floods every year. The province of Phitsanulok and adjacent provinces were able to successfully achieve true implementation. As the Royal Irrigation Department has the Public Participation Promotion Division, the Office of Water Management and Hydrology and the Office of Project Management, which have expertise in water management and lessons learned in the aforementioned project, the Royal Irrigation Department is, therefore, requested to report on lessons learned from the Bang Rakam Model 60 Project in terms of the following five objectives: water management, society, environment, economy and public relations. The venue for the report on lessons learned is scheduled to take place at the Convention Hall of the 39th Military Circle on 11 September 2017 with the involvement of 120 participants. Additionally, budgetary support is sought from the Royal Irrigation Department in order to prepare the stage for the extraction of lessons learned from the "Bang Rakam Model 60 Project".

Thus, you have been notified for your consideration.

Respectfully,

Major General *-Signature-*
(Panuwat Niaonaan)
Commander, Peace and Order Maintaining Force, Phitsanulok

Civilian Affairs Department
Tel.: 0 5524 5070-9 to 73183

Letter of the Peace and Order Maintaining Force Headquarters, Phitsanulok, Requesting Report on Lessons Learned from the "Bang Rakam Model 60 Project"

Chapter 2
Bang Rakam Model Project

2.1 Project Information

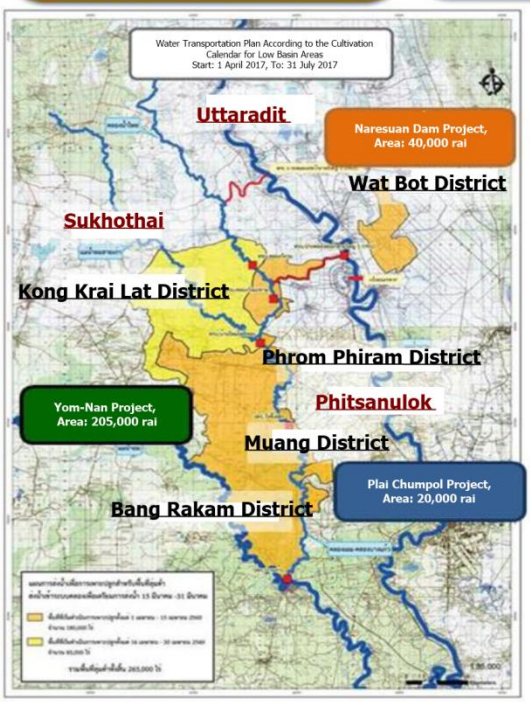
Farmers living in the low areas of the Yom River Basin encounter floods during the rainy season from August to October every year due to the physical characteristics of the Yom River Basin, which constitutes a steep slope stretching from the upper portion in Phrae down to Sukhothai. In addition, the middle section is composed of Kong Krai Lat of Sukhothai and Phrom Phiram and Bang Rakam of Phitsanulok and has the characteristic of a flat basin, also known as the low point of the Yom River Basin. To meet needs of the farmers in the low basin areas of the Yom River within the zone of irrigation, the farmers need to urgently cultivate their crops before the annual rice crop irrigation season in order to avoid crop flooding. Hence, they required the Royal Irrigation Department to adjust the cultivation calendar only for the low basins of the Yom River and requested dry season irrigation (off-season cultivation) to take place from December to March and for rainy season irrigation (annual cultivation) to take place from April to July to allow the local farmers to produce two crops annually. Furthermore, during the monsoon season from August–November, the farmers would not cultivate and would engage in other supplementary occupations such as fishery, fish-sauce-making and pickled-fish-making due to the availability of water storage. Otherwise, they would engage in work for hire to provide additional income to their families and enhance their earnings to improve their livelihood.

The adjustment in the rice cultivation calendar of the farmers this year follow the policy of General Chatchai Sarikalaya, Minister of Agriculture and Cooperatives and the needs of the local water users and farmers. Upon entering the local area to monitor the situation and resolve flooding in Sukhothai and Phitsanulok on 20 September 2016, the Royal Irrigation Department was instructed to adjust the annual rice cultivation plan to take place sooner for irrigation areas in low basins in order to prevent floods from impacting farmers, because low basins are at high risk for flooding during the monsoon season, which coincides with the regular annual rice cultivation season, i.e., August–October. The objective is to ensure that farmers are able to harvest their produce before the arrival of the monsoon.

The Royal Irrigation Department adjusted the rice cultivation calendar for 2017 in the low basin areas under the management of the Regional Irrigation Office 3 for annual rice cultivation to take place sooner from originally during May to begin at 1 April 2017 and last up to 31 July 2017. The total volume of water that is allocated for cultivation is 228 million cubic meters. In April, the water requirement plan for farmers to begin cultivation during April involves 61.77 million cubic meters of water. Target areas cover 265,000 rai in the project area: 205,000 rai in the Yom–Nan area, 40,000 rai in Naresuan Project and 20,000 rai in the Plaichumpon Project. This covers two provinces, five districts, 20 sub-districts and 93 villages, i.e., Prom Phiram, Muang, Bang Rakam and Wat Bot in Phitsanulok and Kong Krai Lat in Sukhothai. The water release took place on 20 March 2017 to let water into water transportation canals and branch canals to prepare for transporting water into the water distribution system to allow farmers to begin cultivation on 1 April 2017.

Target Low Basins for Water Transportation

Cultivation Areas* in the Irrigation Zone Amounts to *265,041 Rai.



Province	District	Sub-district	Village No.	Target Area
Phitsanulok	Phrom Phiram	Tha Chang	7,8,9,10,11,12	12,300
		Wang Won	3,4,5,6,7,9	38,338
		Nong Khaem	2,5,6,7,8,9,10	14,359
		Phrom Phiram	1,10,11,12,13,15	21,520
		Matong	2,5,8,9,10	7,270
		Dong Prakham	10	360
		Thap Yai Chiang	3,4,5,6	8,040
		Ho Klong	5,7	4,560
	Muang	Ban Krang	6,7,8,10	13,430
		Phai Kho Don	3,4,6	3,670
	Bang Rakam	Chum Saeng Songkhram	1,2,3,9	23,400
		Tha Nang Ngam	3,5,8,9,10,11	29,700
		Bang Rakam	15	1,300
	Wat Bot	Wat Bot	3,4,7	910
Sukhothai	Kong Krai Lat	Kok Raet	1-12	17,221
		Dong Dueai	2,4,6,7,9,10	20,196
		Ban Mai Suk Kasem	1-8	18,932
		Krai Klang	1,2,4,8	7,453
		Krai Nok	2,5,7,8	17,840
		Krai Nai	9	4,242
Total (2 Provinces, 5 Districts, 20 Sub-districts, 93 Villages)				265,041

2.2 Project Objectives

1. To provide space for accommodating water during the monsoon in the Yom River Basin to reduce impacts from floods occurring in communities and governmental facilities at Sukhothai.
2. To provide a space for retaining water to slow water drainage to not affect the Lower Chao Phraya River Basin. The maximum water retention volume is roughly 400 million cubic meters.
3. To save government spending in providing assistance to agricultural disaster victims.
4. To save government spending in preventing floods that cause damage to agricultural areas.
5. To promote farmers with supplementary income from fishery, one of the livelihoods of local farmers.

The water transportation plan for low basins integrated every sector with related agencies such as the Third Army, the Ministry of Interior, the Ministry of Agriculture and Cooperatives and local farmers at the low basin area of Bang Rakam to set work objectives, schedule and assign work to each agency in order to achieve the project's objectives. The water management plan and timeframe are as follows:

1. Water Management to Start the Annual Rice Cultivation Season of 2017

20 March–30 March 2017, water was transported to water transportation canals and branches to prepare for delivering water to the water distribution system to allow farmers to begin cultivation on 1 April 2017.

1 April–10 May 2017, the transportation of water to low basin areas vulnerable to flooding was commenced.

2. Water Management to Control and Protect Annual Rice Cultivation Areas

10 May–15 Aug 2017, water management control and flood protection took place to prevent impacts and to allow farmers to harvest their produce before the arrival of the monsoon.

3. Water Management to Drain Water into Water Retention Areas

15 August–30 October 2017, accommodating areas for flood water from the Yom River and tributary water courses along with local precipitation were prepared to regulate levels from affecting residential traffic. The aforementioned areas could support up to roughly 400 million cubic meters of water.

4. Water Management to Drain Water from Water Retention Areas

1 November–30 November 2017, water was drained out of the water retention areas to allow farmers to begin off-season rice cultivation in line with the cultivation calendar of the Royal Irrigation Department.

Chapter 3
Agency Roles

3.1 Agency Roles

Irrigation: Supervision of water transportation planning, public announcements (field inspection, organizing meetings/community discussions), control of water transportation to follow the plan and transportation of water to farmers in areas of responsibility with consideration to area prioritization. The primary duty is to act as the coordinator with local leaders and agencies to have understanding about the project that the calendar was to be changed to accelerate water transportation to ensure that leaders have knowledge and understanding necessary to explain to local villages about the objectives. Once leaders had understanding, if the government work does not meet the needs of the people, there would have been no benefit from the Bang Rakam Model Project. Furthermore, the leaders needed to understand the water levels at water gates. In addition, inspections were conducted on the readiness of irrigation structures/canals/weeds, and assistance was provided to troubled farmers such as by providing water pumps, machinery and fuel.

Fishery: Information was provided about fishery, regulations were revised to be consistent with the Bang Rakam Model Project and announcements were made to local leaders. In addition, supplementary aquatic animals were released, namely, 1,000,000 freshwater fish, 1,000,000 freshwater prawns and about 1,000,000 other ordinary freshwater fish. Releases were made in February prior to the start of the cultivation season. Subsequent to the release of the fish, locals earned increased revenue.

Sub-district/District Agriculture: Supervised farmers in the entire system from the commencement of cultivation to when rice was to be planted. Public announcements were made on which rice strains were suitable to the local area as well as rice prices. Furthermore, alternative crops were sought. Coordination and education needed to be provided to farmers in addition to farmer registration in order to provide assistance to farmers. Progress reports were made, and meetings with farmers and various agencies were organized weekly.

Livestock:	Knowledge was provided on animal husbandry. It is not popular to raise large animals in flood-prone areas.
Military:	Supervision of providing support to all parties in supervision, control and public announcements. In actuality, it largely acted as referees, since the Bang Rakam Model Project was only in its first year. The rules for when water arrives are to first let the water flood. Human nature tends to be selfish, so some might pump water in an effort to steal, or a sub-district might release water a certain way. For the most part, the military acted to mediate and assist in negotiations. The primary role of the military is to provide coordination between local villagers. The villagers reached out to and consulted with the military first. The military has stations at Damrongdhama centers. There were hundreds of complaints, most of which were concerned with floods. However, it was impressive that the villagers cooperated very well. Everyone was united in every sub-district. The village chiefs of every village of Bang Rakam and leaders in all sectors gave excellent cooperation. As for the SAO, after the conclusion of harvests, it was found that the rains arrived early this year. So, for parts that were not yet harvested, the military came in to help and acted as referees and mediators in coordination. Furthermore, the military provided equipment and machinery support such as diggers and constructed make-shift dikes.
Local:	Made public announcements to the villages. There was a need to be prepared, know the conditions of the land and know when the water would arrive in order to communicate accurately at the community level and build understanding among villagers and farmers. We used sub-stages on which farmers could gain awareness on the village level. Sub-details were sent to villagers. Improvements were achieved but not fully. However, this year has been the most productive. Therefore, it is a success. Last year, 50 percent of the crop was damaged but only about five percent became damaged this year. The results are satisfactory.
Community Leaders:	They provided coordination and promoted participation with the Royal Irrigation Department and farmers. Leaders had to attend meetings, follow up on meetings and explain outcomes to farmers. The

	famers achieved understanding and successfully harvested their crops before the monsoon.
Administration:	Provided coordination between locals, the military and the Royal Irrigation Department. Coordination centers were established to resolve local problems, most of which utilized telephones or the LINE application.
Farmers:	Reported news when water was turned on or off and shared information with adjacent rice farmers in order to proceed according to plan such as by appropriately changing rice strains and planting according to schedule.

Phrom Phiram, Phitsanulok

Bang Rakam, Phitsanulok

Muang, Phitsanulok

Kong Krai Lat, Sukhothai

Chapter 4
Factors Contributing to Success

4.1 Factors Contributing to Success

1. Water Management

Irrigation: As the Royal Irrigation Department, the first factor contributing to success is water capital. The fact that we successfully implemented the Bang Rakam Project is due to our ability to transport water in April. Without water capital, if the water in Queen Sirikit Dam is low, it is the end. The second factor, in addition to water, is planning in water management based on set objectives on schedule and in line with set goals in the Bang Rakam Model, i.e., on time and in the right place.

Farmers: Success required adjustments in the cultivation plan to concur with the Bang Rakam Model Project.

Fishery: Water delivery to the areas should last for a period of four months. With any less water, fish would not grow in time. In other words, the period of inundation should be sufficient for utilization. Furthermore, areas or the scope of release of water should be clearly specified.

Community Leaders: Previously, water was not managed in the aforementioned manner, and there were no rules. Now, however, there is no need to fight over water. This has contributed to success. Additionally, the cultivation calendar was adjusted, and crop registration was made to ensure consistency with the Bang Rakam Model Project. Emphasis was placed on negotiations and talks.

Livestock: In the Bang Rakam Model Project, if Phrom Phiram and Kong Krai Lat were not included, there would have been no success. Farmers need to be generous with one another other. This led to rules.

2. Society

Farmers: Every party cooperated and was generous. More time was allocated for communication. Emotional states improved. Community relationships improved. Furthermore, the military helped maintain order and reduced swindlers.

Local Leaders: The communities became more united, and there was less conflict in the local areas.

Fishery: Cooperation and learning were achieved. However, conflicts might have occurred among people inside and outside the areas in regards to fishery.

Military: Help increase understanding in communities. Each area has basin and elevated parts. When water from canals is transported, people located upstream would like natural water, while people located downstream do not get water at all. As a result, they let the people at the end of the line pump water first. Everybody shared. The military helped communities to be generous. The government visits to coordinate the people in the communities, leading to mutual understanding in villagers. From April to May, the military visited three days every week for twelve consecutive times every month without a day off. After people finish planting their crop, they stop fighting and have more confidence in their livelihood. They would not have to wait until rain arrives and could plan ahead. Next year will be much smoother and no pumping of water will be necessary for certain.

3. Economy

Farmers: The water management in line with the Bang Rakam Model affected the economy since April. It allowed harvests to take place on time by over 90 percent. Thus, household economy was rather good. As for water retention areas, at least 500 fish per household were caught there. Some people also worked to harvest rice for hire.

Fishery: People processed aquatic animals and manufactured fishing equipment for sale.

Livestock: Farmers have security, sold rice for value and harvested profitable crops.

Military: Previously, any year with floods immediately meant failure, while other years without floods meant survival. In addition, sometimes water does not even arrive in May. With the project, now farmers can plan their cultivation and reduce risks.

Irrigation: Rice can be sold for better prices, which is a motivator for farmers. Delivering water by 1 April benefits farmers. In addition, the fact that we release water into the fields resulted if rather successful crops, resulting in increased yield. As a consequence, farmers have credit with stores, and stores have confidence, and harvester owners feel confident in their work for hire. Moreover, after water was released into the fields, fish became more abundant.

4. Environment

Farmers:	There is less pollution resulting from the use of water pumps. In addition, water helps cleanse chemicals and enrich the soil while eliminating weeds at the same time. Moreover, the fish grow fast. If only waiting for natural water, sometimes there is only wastewater left from water logging.
Fishery:	It provides a source for multiplying natural aquatic animals.
Military:	It reduces costs. When water arrives, fertilizer is brought with the water. Natural fertilizer is received. This reduces cost. In addition, herbicides do not need to be used, or else the soil would be acidic. Upon completion of one cycle and water arrives, another cycle is started right away. If water floods for three to four months, everything dies, less pesticides/herbicides are used.
Irrigation:	Nature returns. The richness of the local area is an indicator.

5. Public Relations

Sub-district/District Agriculture:	Help provide information to the public about cultivation calendar changes and provide assistance in sowing preparations such as by preparing paddies, equipment and rice strains as well as farmer registration in the system.
Military:	Work to reach out to the public, primarily to village leaders. Meetings were organized in each village about serious issues. In addition, social networks were utilized, for example, LINE groups about water management, the Bang Rakam Model, the Kong Krai Lat Model, community leaders' network, etc.
Livestock:	Accept famer applications during public relations.
Community Leaders:	News correspondents visited local areas.
Irrigation:	Activities were organized about water transportation to create a current and spread news to the general public. In addition, district-level agriculture, irrigation and military agencies along with local leaders hold meetings before implementing the project and organized a public discussion forum.

Mind Map of the Five Factors Contributing to Success: Water Management, Society, Environment, Economy and Public Relations

Chapter 5
Opportunities for Improvement

5.1 Opportunities for Improvement

Farmers: We would like natural water transportation canals to be improved for ponds to be dug and roads and dikes to be reinforced. Previously, when canals were dredged, soil would be dumped to the side and not utilized. We would like laws to be revised to allow farmers with homes located adjacent to canals to utilize the soil. Furthermore, we would like regulations for assisting farmers affected by natural disasters to be expanded to extensively cover the areas inside the Bang Rakam Model. In addition, we would like the water release date to be 15 March because water has to be delivered to the ends of the canals first. If water is released on 1 April, rice cultivation would begin on 15 April. Lastly, we would like the duration of the first round of water transportation to be extended from seven days to ten or twelve days.

Administration: We would like the maps of the irrigation, agriculture and administration departments to be integrated to ensure consistency and standardization.

Community Leaders: We would like plans to be set in place for dealing with natural disasters. Occasionally, crops have to be harvested early, which decreases rice value. Rules should also be changed to have clarity and cover water users. In addition, public relations methods should be improved, for example, by setting up vinyl boards to explain rules in every village, and letters and announcements should be clarified.

Irrigation:	In the previous year, the land zoning at the Bang Rakam Model 60 Project utilized land formation. In subsequent years, land changes need to be made. It is necessary to include problem areas in the creation of the improvement plans for year 61 (2018), e.g., raise road heights, procuring water sources to act as water reserve areas and promoting processing of agricultural produce and aquatic animals.
Sub-district/District Agriculture:	The areas should be readjusted to match facts. The Royal Irrigation Department should coordinate with farmers to ensure that information is reported based on facts.
Livestock:	Improvements should be made to laws and regulations for concurrence with the objectives of the project and government duties.
Military:	The Bang Rakam Model should be expanded to cover other affected low basin areas in the same manner as Bang Rakam. Contingency plans should be made for cases involving excessive and water shortages. Furthermore, cultivation of plants that are capable of surviving four months of water should be encouraged, namely, morning glories.
Local:	Urgently carry out construction projects and construct structures to direct water in the Old Yom River and draw water at intervals.

Expression of Opinions of the Participants to the Report on Lessons Learned

Representatives from Each District Presenting the Report on Lessons Learned

Chapter 6
Main Factors for Expanding Results and Recommendations

6.1 Main Factors for Expanding Results and Recommendations

1. Where should the Bang Rakam Model 61 be implemented?

1) Implement the project at the same area of the Bang Rakam Model 60 Project and expand to cover affected areas.

2. Can it be achieved?

Yes, if the following factors are present:

1) Water capital from Queen Sirikit Dam is available.
2) People are ready to cultivate early (planning).
3) A scope is set for water transportation (transportation canals).
4) Clear irrigation zones are designated.
5) Cooperation is offered by every sector.
6) Public announcements are made in advance.
7) Field water is present for preparing planting areas.
8) Examples/models from year 60 (2017) are available.
9) A committee is in charge.
10) Farming discipline is exercised.
11) Examples and lessons from year 60 (2017) are present.

3. Who will implement it?

1) Four-party committee as follows:
   - Royal Irrigation Department.
   - Administration (village headmen, village chiefs, sub-district administrative organizations and district administrative organizations).
   - Farmers (groups of farmers who use water).
   - Government agencies (Agriculture).
2) Military (security).
3) BAAC.
4) Provincial Commerce Authority.
5) Buyers such as rice mills.
6) Rice Department

4. How is it to be implemented?

1) Base the timeframe on 1 April.
   - Change the plan for water transportation to canals to be sooner.
   - Ensure that water is present in canals.
   - Ensure that the military regulates the water usage (if discipline is absent).
2) Plai Chumpol Water Transportation and Maintenance Project releases water at the same time as the Yom–Nan Water Transportation and Maintenance Project.
3) Dredge the concrete surfaces of water transportation canals.
4) Public relations, voice on line, and meetings at village level.

5. When is it to be implemented? (How, When, Which month?)

1) The four-party committee and related persons hold meetings at the end of October.
2) Water transportation begins on 15 March to prepare fields, and cultivation commences on 1 April.