

Sub-area Study and Analysis 3T Sub-area



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THAI NATIONAL MEKONG COMMITTEE
DEPARTMENT OF WATER RESOURCES
MINISTRY OF NATURAL RESOURCES
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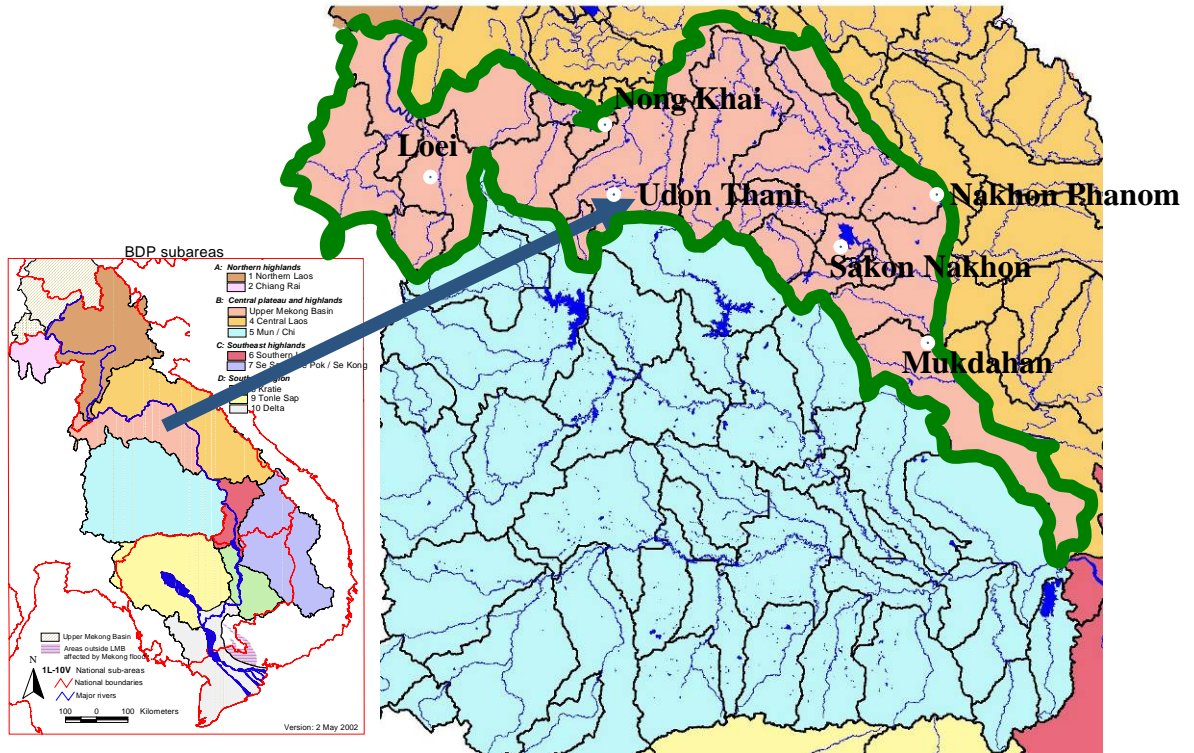
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Acronyms and abbreviations

BDP	-	Basin Development Plan
DWR	-	Department of Water Resources
EGAT	-	Electricity Generating Authority of Thailand
FYP	-	Five Years Plan
GPP	-	Gross Provincial Product
GMS	-	Greater Mekong Sub-region
kW	-	Kilowatt
kWh	-	Kilowatt-hour
MCM	-	Million Cubic Metre
MRC	-	Mekong River Commission
MSL	-	Mean Sea Level
MW	-	Megawatt
PWA	-	Provincial Waterworks Authority
RBC	-	River Basin Sub-committee
RBO	-	River Basin Organization
RWO	-	Regional Waterworks Office
RID	-	Royal Irrigation Department
SA	-	Sub-area
SAWG	-	Sub-area Working Group
TNMC	-	Thai National Mekong Committee
WHO	-	World Health Organization

Map of sub-area 3T



Executive summary

- I. The total area of SA-3T is 46,460 km². This SA extends over eight northeastern provinces in the Mekong River Basin, i.e. Udon Thani, Sakon Nakhon, Loei, Nongbua Lamphu, Nong Khai, Nakhon Phnom, Mukdahan, and Amnat Charoen.
- II. The Ninth National Economic and Social Development Plan stipulates that an efficient use of water resources is supported to ensure sustainable and equitable benefits.

The present government's policies delivered to the National Assembly on 26 February 2001 have embraced natural resources and environment issues as follows:

- To manage the environment, natural resources and biodiversity in an integrated manner;
- To promote and encourage participation;
- To support the notion of taking social costs into consideration;
- To promote technological research and development with a view to increasing Thailand's capacity to manage, conserve and restore the environment;
- To set national environmental standards;
- To set standards for controlling the importation of chemical, toxic and hazardous substances.

Thailand has adopted a new concept of regional administration - a bureaucratic system that can efficiently respond to the Government's strategic management. For effective management, provinces have to be grouped together. Provincial water resources management plans will be in line with these strategies. SA-3T mainly covers the Upper Northeast provinces as follows:

Group 1: Udon Thani, Nong Khai, Nong Bua Lam Phu, and Loei. Four strategies were formulated for this group.

- Ecological Restoration Strategies
- Agro-industry Strategies
- Cross-border Trade Development Strategies
- Tourism Strategies

Group 2: Mukdahan, Nakhon Phanom, and Sakon Nakhon with four main strategies

- Human Resources Development Strategy
- Tourism Development Strategies
- Cross-border Trade Development Strategy
- Agricultural and Industrial Development Strategy

- III. The climate of the Mekong River Basin is primarily influenced by the Southwest and Northeast monsoons. It is also subjected to depressions from the South China

Sea each year. Consequently, heavy rains are observed during the wet season. There are three seasons in the area, i.e. rainy season, summer, and winter. Mean annual temperature is 26.3 °C. The mean annual rainfall of every province in SA-3T is 1,492 mm/year. The mean annual runoff totals 26,475 million cu.m.

- IV.** The total population of SA-3T is 6,117,042 persons. The average income/person/year in the SA is 24,011 baht/person/year, while that of the northeastern region is 24,783 baht/person/year. The national average income/person/year is 65,235 baht/person/year.
- V.** Priority is given to watershed management, environment, and fisheries sectors. They are closely interwoven with the way of living of the inhabitants in the river basin, especially Nam Songkhram River. The future development of SA-3T will be in line with the strategies of provincial groups by optimizing the strengths of each province. The development under the BDP context should also correspond to this framework, e.g. collaborative learning approach on watershed management to ensure adequacy of water resources for dry-season cultivation and water supply for the local people's consumption.

Introduction

The Basin Development Plan (BDP) is one of the four core programmes of the Mekong River Commission (MRC) with the following principal concepts and process.

(1) A development plan with emphasis on stakeholders' participation in the formulation process in accordance with the specified and well-accepted five stages.

- ◆ Sub-area Study and Analysis;
- ◆ Formulation of development scenarios;
- ◆ Preparation of integrated development strategies;
- ◆ Compilation of a long list of projects and programmes;
- ◆ Preparation of a short list of priority projects and programmes.

(2) The Lower Mekong Basin (LMB) is divided into 10 sub-areas (SA) based on the hydrological conditions and country boundary. The Mekong Basin's part in Thailand includes SA-2T (covering Kok and Mekong river basins in the North), SA-3T (Mekong River Basin in the Northeast), SA-5T (Chi and Mun river basins), and SA-9T (Tonle Sap sub-basin) (Figure 1 depicts the BDP sub-areas of the Lower Mekong Basin.)

(3) Three activities were simultaneously undertaken, i.e. (1) formulation of development plan, (2) public consultation and participation, and (3) capacity building of the institutions and stakeholders involved in this plan.

Activities accomplished in April 2004 encompass the preparation of Integrated National Sector Overview which presents an overview at country level of eight sectors related to the Basin Development Plan, namely, watershed management, irrigated agriculture, water supply for domestic and industrial uses, hydropower, flood management, fisheries, navigation, and tourism. This report gives details sub-areas 3T with focus on major sectors.

Context and scope of sub-area analysis

- (1) To analyze the present situation of each sector under the BDP in the sub-areas;
- (2) To serve as a sub-area situation report for other member countries, with some important data to be used in formulating more specific regional development scenarios and strategies;
- (3) To provide preliminary data for transboundary meetings;
- (4) To support the first stage of BDP collaborative learning approach and to be the starting point of the process.

National Overview

Some 25 million people live in the Basin's part of Thailand. More than 80% of the population is farmer, growing particularly rice which constitutes the largest portion of all, i.e., about 35 million rai (or, 5.6 million ha). Irrigation area is 8.84 million rai. However, soil fertility is rather poor and of low fertility, with a wide spread of salinity soils. These form a major problem that made it difficult for development and accordingly, revenue of the people, particularly farm income, is low in general.

When compared it to the national profile, it may be said that the Mekong Basin's part in Thailand is least developed; the basin's inhabitants have low income, causing such social problem as migration of labor to other regions. However, depending on the possible use of Mekong water and its related resources, this part of the Basin still has a high potential for development in such areas as industries, tourism, energy, irrigated agriculture, etc.

I. Watershed Management

1. In the Mekong Basin's part of Thailand, lands classified as classes 1 and 2 that are important watershed of river-basins, are very limited in general. For the Mun basin, area of these two categories is only 3.4% (of total basin's area). For the Chi and the Kok basins, they are 13.3% and 36%, respectively.
2. Management of forest/watershed upstream is a part of "river basin management" which normally covers various activities, including allocation of water (quantitatively and qualitatively) among different economic sectors within a basin. It represents, however, one of the most important work/tasks of the MRC.
3. The national FYPs, since the 3rd one of 1972-1976, and especially the Cabinet resolution of October 2000 on National Water Policy have set forth important directives for managing watershed and water resources of the country.
4. As an effort to solve the problem of water shortage during the dry season which is critical in every part of the Mekong Basin, to undertake a comprehensive study and to plan for utilization of underground water within the basin. In the longer term perspective, measures may include diversion of water from nearby basins, taking fully into consideration physical feasibility and possible impacts thereof.

II. Irrigated Agriculture

1. More than 22,300 irrigation projects have already been developed and constructed in the Mekong Basin's part of Thailand, with the total benefited area of over 8.84 million rai. Nevertheless, the irrigated area is small compared to the existing agricultural lands in total. Moreover, large-scale irrigation projects are located mainly in sub-areas 3T and 5T, e.g., Ubon Ratana Dam, Sirindhorn Dam and Lam Pao Dam. In sub-areas 2T and 9T, most of the projects are of small- to medium-scale with a limited storage capacity. Others are electrical pumping stations that do not have structures for storing water.

2. Problems relating to irrigation in Thailand include lacking of a “unity” in water management work which normally performed by many government departments and agencies, particularly before the implementation of bureaucratic reform. Others problems are the “free access” to and the lack of “effective allocation measure” for water. These have resulted in uneconomic, ineffective and unjust water utilization, leading eventually to the problems of conflict and competition among water users. Additionally, there are such problems as the lack of demand-side-management measures, limited knowledge on the basin’s ecology, unavailability of appropriate management pattern and no participation of the water users.
3. Relevant policies to help solve the problems include establishment of a unified water management system, enactment of law and improvement of regulations related to water resource, public/people’s participation in water management, decentralization of authority from the Central to regions through the establishment of so-called “river basin sub-committee (RBC)”. Certain roles of the Royal Irrigation Department (RID), for example, would be delegated to local authorities. Other supplementary measures include public relations activities, involvement of private sector in doing operation and maintenance work, collection of fees to cover recurrent cost and/or application of cost-sharing principle for constructing irrigation systems.

III. Water supply for domestic and industrial consumption

1. In quantitative terms, the demand for water for domestic uses comprising home consumption and industrial use, represents the 2nd largest of all. However, it was only recently that MRC has taken this into consideration under the BDP context. Apart from an effort to meet the demand, development of water for domestic uses could contribute to improvement of quality of life of the people living within the basin and enhance sustainable development in the longer term.
2. PWA is considered the main agency. As a policy, it places an emphasis on quality of the water, following the standards established by the World Health Organization (WHO). Its target is to make waterworks available to rural areas at the rate of 400 villages a year. Priority is to be given to projects where the people are most suffered with shortage of water for home consumption. PWA has also a target to increase its service areas of “potable water” for at least 10 places a year. By 2023, it is expected that all the service areas will be able to provide potable water from tab.

IV. Hydropower

1. Under the Context of the Mekong Committee (1957-1995) and the MRC (1995-present), Thailand has been promoting studies of potential hydropower development within the Mekong River Basin. A large number of potential projects has already been studied and developed. Several others are still have to be studied further, although the chance for such the development become limited, due to the exhaust of appropriate development sites for large-scale dam construction and opposition of NGOs, domestically and internationally, against construction of dams.

2. The key agencies responsible for hydropower development in Thailand include Electricity Generating Authority of Thailand (EGAT), the Department of Alternative Energy Promotion and Energy Conservation, the Provincial Electricity Authority, the Royal Irrigation Department, etc. Up to the present, some 1,022 units of hydropower related projects have already been developed in the Basin's part of Thailand. Of these, 12 projects have been installed with electricity generators, with a combined capacity of 241 MW. This constitutes about 8% of all the hydropower plants' capacity (2,939 MW) but, just 1% of the total power generating capacity of the country (25,638 MW).
3. Taking power demand in sub-areas 3T and 5T as an example, the peak demand is estimated at 2,006 MW or 7.8% of the total country demand (figure of May 2003), while the total energy consumption is 10,387 million units per year, or 8.9% of the country. This means that on the average, per capita power demand of the people in the basin is only 0.091 kW, with an average energy consumption of 472 kWh/head/year. These figures represent only 31% and 25%, respectively of the national averages. Forecasting figures for the power demand and power consumption of the people in the Basin's area of Thailand in the next 10 year are 2,717 MW and 19,886 million units, respectively.

V. Flood Management

1. The Mekong River Basin is subject to frequent flooding. Within the Basin's part of Thailand and particularly in the wet season, the rising water level of the Mekong river often overtops the river banks in Nong Khai, Nakhon Phnom and Mukdahan provinces. Sub-basins where flood occurs frequently are Nam Songkham and Nam Kam sub-basins, due to their topographical locations which are relatively low and, lack of effective protection schemes and measures. Currently, Flood Mitigation and Management constitutes another key Programme of the MRC, comprising various new components in addition to the "flood forecasting" which has been implemented continuously in the past.
2. Important policy related to flood and following the resolution of the Cabinet of 31 October 2000 stipulated that the plans for mitigating flood and drought problems should be formulated for areas. Flood forecast, flood mitigation methods and restoration of flood damage should be implemented effectively and justly, taking fully into account the land-use and natural resources involved.
3. In addition, there is a set of policies of the Ministry of Natural Resources and Environment that influences either directly or indirectly flood mitigation activities in the country. They include the policy for reserving, developing and conserving natural resources and the one for resource utilization to meet the various demands to the maximum potentials while sustaining the benefits.
4. In view of the fact that flood problems could be caused by both natural-geographical factors and human acts: economic growth coupled with construction of infrastructures, expansion of urban areas, destruction of swamp/flood plains, forest and watershed areas, etc., flood protection/mitigation measures should therefore comprise of those of engineering and non-engineering structures. They include, for example, improvement of rule/operation curve for managing the existing reservoirs, installation of flood forecast system, construction of natural

flood plains, excavation of culverts/diversion routes, expansion of waterways, construction of large-scale projects specifically for flood protection purpose, etc.

VI. Fisheries

1. Fisheries are important to both consumption-life of the people as well as economics of the country. Because fisheries are also important natural resources of the Mekong Basin that are shared and owned commonly by the riparian countries and peoples living within therein, development of fisheries constitutes one of the most important and key activities of MRC.
2. National policies related to the development of fisheries (2002-2006) include those for the development of fishermen and related institutions, a policy for managing fishery resources and environment, a policy for the development of fish culture and a policy for the development of fishery industries and business which emphasise people's participation in the management of fisheries that will eventually lead to a sustainable development in this sector.
3. Apart from the Department of Fisheries, there are several other responsible agencies, e.g., the Royal Forest Department which is responsible for forest areas including the mangrove necessary for spawning and raising young fish/fingerings, the Department of River-borne and Maritime Transportation which is responsible for registering fishing boats, RID and EGAT which play important roles in managing fisheries in both the reservoirs and rivers, DWR which is responsible for overall management and allocation of water, the Pollution Control Department which is responsible for protecting and solving the problems related to water pollution caused by such things as urban growth, industries and untreated polluted water from agriculture.
4. There are many important factors that cause problems and threat to the well-being of fishery resources, e.g., waste from industries which tend to reduce the quantity of solute oxygen, salinity water caused by underground salt, dam construction which obstruct fish migration, out-law fishing or the use of too powerful fishing-gear to destroy fish, cross-breeding of imported/alien fish species, etc.
5. To increase fishery resources enough for meeting the future demand, several measures for solving the above-mentioned problems are necessary. These may include rehabilitation of water resources, the release of more fingerling to public water bodies, setting up of conservation areas for flora and fauna, restricted areas for fisheries, etc.

VII. Navigation

1. Water-borne transportation on the Mekong and in particular, the Mekong tributaries in Thailand has rapidly lost its importance due to the relatively fast development of road and highway networks in the country. Nevertheless, the use of the Mekong by Thailand and her neighboring MRC member countries for transportation of goods and tourism (river-based tourism) purposes is still significant.
2. National policies related to the river-borne transportation/navigation on the Mekong river include the development of maritime/trading system to support

export business of the country by means of, for example, the development of commercial fleets and strengthening of related industries, construction and management of harbors and deep seaports and cooperation in the establishment of communication and transportation networks and safety measures for inland navigation that link to her neighboring countries.

3. Important problems related to water-borne transportation are bank erosion caused by nature or human act (e.g., sand dredging, construction of buildings in the river, etc.) and sedimentation which make river channels shallow.
4. Long-term development in this particular Sector of Thailand concentrates mainly on the improvement of the aforesaid river-ports at Chiang Saen and Chiang Khong, to meet the increasing demand for transporting goods and tourism on the Mekong. Others include small-scale development and construction of bank protection work, particularly in the areas where problems are most acute to the people's and public properties.

VIII. Tourism

1. Tourism has become one of the most important economic sectors of Thailand. Compared to revenue from other export-goods, tourism can generate income and bring in the largest amount of foreign currency to the country, contributing to stabilization of balance of payment and solving many critical problems of the country. However, activities related tourism are least developed in the context of MRC work, which concentrate principally on the river-based and eco-tourism. Role of the MRC in this particular sector is therefore still very limited and, needs to be performed in conjunction with other development sectors, such as, navigation, conservation of river ecology, environmental protection, etc.
2. National policy and plan for 2004-2006 reflect a strategy for the development of tourism sector in the long-term perspectives. These include the expansion of touristic area to cover a wider Region with Thailand as the center of the network, the shifting of emphasis from quantity to quality, the increase in management roles of local institutions, the importance being placed on the development and rehabilitation of natural resources, etc.
3. Recently, six countries in the Greater Mekong Sub-region comprising Cambodia, China, Lao PDR, Myanmar, Thailand and Vietnam have agreed to jointly develop tourism in the Mekong River Basin aiming at a sustainable benefit, reduction of development cost, a full satisfaction of tourists and, an increase in capacity for competition in the market which in the future, is to become a "single tourism market", with the Mekong River as a selling point. Thailand has a clear role of being a gateway to the Region. Other countries have also been constructing various infrastructures that make a network linking to the Mekong.

Sub-area baseline study

Development Objectives, plans and policies

The Ninth National Economic and Social Development Plan stipulates that an efficient use of water resources is supported to ensure sustainable and equitable benefits by:

- (1) To manage the existing water resources and bring them for use to the maximum potential for agriculture, production, and consumption including change of agricultural production system by shifting to less water consuming crops as well as increase in water use efficiency;
- (2) To manage multi-purpose water resources by means of people's participation process from project preparation and allowing the beneficiaries to involve in investment;
- (3) To study ways and means to manage groundwater, quantitatively and qualitatively, in accordance with its potential as well as to investigate and monitor the land subsidence to proclaim areas of underground water control and to solve the decrease of underground water;
- (4) To enable collection of service fees on raw water being used for industries, commerce and water works together with campaigns and building the public awareness of conservation of water quality and efficient water use;
- (5) To develop water forecast system to improve the management efficiency so as to mitigate water shortage, flood, and water supply problems;
- (6) To formulate a master plan for integrated water management at basin level, emphasizing management of water quality and critical basins as well as participation of the people and communities in the implementation

The present government's policies delivered to the National Assembly on 26 February 2001 have embraced natural resources and environment issues as follows:

- (1) To manage the environment, natural resources and biodiversity in an integrated manner by upholding the principles of good governance and popular participation by the people and the local community;
- (2) To promote and encourage participation by the people and the community in waste control and waste disposal, both of which affect the health, welfare and quality of life of the people;
- (3) To support the notion of taking social costs into consideration when conducting project evaluations of repercussions on the environment and natural resources. In managing the environment and natural resources, the Government supports the principle that whoever causes pollution shall also bear the costs as well as the system of joint rights;
- (4) To promote technological research and development with a view to increasing Thailand's capacity to manage, conserve and restore the environment. Support the beneficial use of natural resources from all sources, including the recycling of waste and other used materials;
- (5) To set national environmental standards that are suitable for and compatible with Thailand's level of development in the scientific,

economic and social spheres. At the same time, such standards should be in tandem with international environmental standards dealing with international trade;

- (6) To set standards for controlling the importation of chemical, toxic and hazardous substances in accordance with the international standards set by developed countries with a view to preventing Thailand from becoming a test site or commercial site for hazardous substances and materials that are sub-standard.

Thailand has adopted a new concept of regional administration a bureaucratic system that can efficiently respond to the Government's strategic management. This can be achieved through an integrated management system, emphasizing the use of shared resources as well as clearly defined implementation strategies and goals. For effective management, provinces have to be grouped together. Provincial water resources management plans will be in line with these strategies.

SA-3T mainly covers the Upper Northeast provinces as follows:

Group 1: Udon Thani, Nong Khai, Nong Bua Lam Phu, and Loei. Four strategies were formulated for this group.

- (1) Ecological Restoration Strategies, consisting of:
 - 1st strategy: To reduce losses due to natural disasters in consistence with the Royal Initiatives;
 - 2nd strategy: To increase opportunities of water and forest utilization to create ecological balance;
 - 3rd strategy: To expand agricultural production bases through agro-forestry.
- (2) Agro-industry Strategies encompass the following.
 - 1st strategy: To increase production efficiency and competitiveness.
- (3) Cross-border Trade Development Strategies embrace the following.
 - 1st strategy: To develop infrastructure for improving cross-border trade prospects;
 - 2nd strategy: To promote trade and investment cooperation with neighbouring countries;
 - 3rd strategy: To push for the establishment of a special economic zone (Udon Thani-Nong Khai-Vientiane).
- (4) Tourism Strategies cover the following.
 - 1st strategy: To enhance the potential and value of tourism attractions;
 - 2nd strategy: To develop tourism sector personnel;
 - 3rd strategy: To develop tourism information system and public relations;

4th strategy: To promote international tourism cooperation;

5th strategy: To develop transportation network among groups of provinces.

Group 2: Mukdahan, Nakhon Phanom, and Sakon Nakhon with four main strategies as follows:

(1) Human Resources Development Strategy

1st strategy: To upgrade and build the capacity of personnel and labour;

(2) Tourism Development Strategies

1st strategy: To upgrade and build the capacity of personnel and labour as well as to enhance the potential and value of touristic sites;

2nd strategy: To develop tourism sector personnel;

3rd strategy: To develop tourism information system and public relations;

4th strategy: To promote international collaboration in tourism;

5th strategy: To develop transportation network among groups of provinces.

(3) Cross-border Trade Development Strategy

1st strategy: To raise trade volumes and values as well as to improve customs process and facilitation of trading activities;

(4) Agricultural and Industrial Development Strategy

1st strategy: To restructure agricultural production system and develop collaboration patterns as well as to promote joint investment with neighbouring countries.

Institutional capacity

In Thailand¹, the BDP Unit established under the Thai National Mekong Committee (TNMC) leads the efforts. The Unit manages day-to-day activities on BDP and as an organ at the national level, coordinates the work with other key stakeholders within the country. Within the Unit, in addition to the Unit Head, there are other key staff, including the BDP Coordinator who is assisted by a full-time BDP National Specialist (a local and external consultant). BDP within the Thai context is steered by a multi-agency BDP National Working Group (NWG) comprising of members from TNMC member ministries/line-agencies.

In the case of Thailand, as an example, the national water policy has been in place since October 2000, in which among others, public participation in water resources planning has been heavily emphasized. Institutional framework for the peoples' network has also been established and expanded for quite some time. On the

¹ Learning note on SA study and analysis, TNMC, October 2004

side of the Government, 25 major river basins have been identified for planning and management purposes. Moreover, 29 RBCs have been established in all these river basins. The terms “sub-area (SA)” defined by BDP are basically similar to the “river basin” defined by the Thai authorities. For the BDP Unit, efforts and time were required much more than anticipated, in order to have all the necessary explanations made to the local people and institutional set-up formalized. This, as a matter of fact, was one of the practical problems experienced by the Unit during the early stage of implementation of the BDP process in Thailand.

BDP activities² in Thailand used the real stakeholders who know their needs and sub-area well. All BDP working groups were selected from RBCs by themselves relate to 8 sectors of BDP (Watershed Management, Irrigated Agriculture, Water Supply, Hydropower, Flood Management, Fisheries, Navigation and Tourism) but not all sectors depend on sub-area characteristic and activities. The members of RBCs comprise with 4 main groups of stakeholder in sub-area as follows:

- 1) Related government official representatives
- 2) Water user representatives
- 3) Academics, local wise persons
- 4) Non government organisation representatives

SAWGs in SA-3T were divided into two groups, namely, SAWG-3T1 and SAWG-3T2. Each WG was official establishment by Chairman of each RBC on August 2004.

Socio-economic description and information on resources users

Population³

The total population of SA-3T is 6,117,042, including 3,072,434 men and 3,044,608 women. Population by province is shown as follows:

Province	Total	Male	Female
Udon Thani	1,535,471	771,441	764,030
Loei	635,587	322,665	312,922
Nongbua Lamphu	498,513	251,471	247,042
Nong Khai	909,543	457,870	451,673
Sakon Nakhon	1,107,752	552,899	554,853
Nakhon Phanom	721,540	360,525	361,015
Mukdahan	338,276	169,727	168,549
Amnat Charoen	370,360	185,836	184,524
Total	6,117,042	3,072,434	3,044,608

² TNMC-BDP Progress Report (April – September 2004)

³ Base Data of Mekong River, Parts 2 and 3 of Department of Water Resources, 2004

Income

Per capita Gross Provincial Product (GPP) income/year in the sub-areas is based on one-year data, i.e. the year 2000, from National Economic and Social Development Board. The study of people's income in rural areas, villages, and tambon within the sub-areas reveals that the structure of household income in the rural areas is mainly based on agricultural activities. Income of the people in 3T-SA is shown as follows:

Province	Per capita GPP (baht/person/year)
Loei	30,736
Nongbua Lamphu	16,832
Udon Thani	26,685
Nong Khai	24,011
Sakon Nakhon	22,442
Nakhon Phanom	21,258
Mukdahan	32,189
Amnat Charoen	17,938

Per capita GPP income/year of Nongbua Lamphu province is ranked the lowest in the SA-3T, i.e. 16,832 baht/person/year. This province has also the lowest earnings in the Northeast and Thailand. If compared to the province with the highest average income/person/year in the SA, i.e. Mukdahan with income of 32,189 baht/person/year, the difference is twofold within the same SA. The average income/person/year in the SA is 24,011 baht/person/year, while that of the northeastern region is 24,783 baht/person/year. The national average income/person/year is 65,235 baht/person/year.

Inventory of physical features and water resources

Geography

The total area of SA-3T is 46,460 km². It is of narrow and elongated shape along the Mekong River. Upland is the general topographical feature of this area, with elevation of 100-200 m MSL. The catchment is bounded to the west and east by high ridges, which dip northwards and eastwards to the Mekong River. This SA extends over eight northeastern provinces in the Mekong River Basin, i.e. Udon Thani, Sakon Nakhon, Loei, Nongbua Lamphu, Nong Khai, Nakhon Phnom, Mukdahan, and Amnat Charoen.

Climate

The climate of the Mekong River Basin⁴ is primarily influenced by the Southwest and Northeast monsoons. It is also subjected to depressions from the South

⁴ Inception Report, Formulation of Integrated Water Resources Management Plan for the Mekong River Basin, Department of Water Resources, 2004

China Sea each year. Consequently, heavy rains are observed during the wet season. There are three seasons in the area, i.e. rainy season, summer, and winter.

The mean annual atmospheric pressure of MRB is more or less the same all over the Basin, with mean value of 1,009.42 millibar. The mean monthly pressure ranges between 1,004.76-1,015.79 millibar, with the minimum and maximum mean monthly pressure recorded at Nakhon Phanom and Nong Khai, respectively. The range of mean monthly pressure is comparatively similar at every station in the MRB.

Mean annual temperature is 26.3 °C while mean monthly temperature ranges between 20.9 °C and 29.8 °C. The minimum of 14.1°C was recorded at Loei province, and the maximum of 36.2 °C recorded at Ubon Ratchathani province.

Mean annual relative humidity of the MRB is 72.5%. Mean monthly relative humidity ranges from 59 to 88%, with the minimum recorded at Udon Thani and the maximum at Nakhon Phanom.

Rainfall

Mean annual rainfalls of SA-3T were derived from the analysis of rainfall data from 159 gauging stations with the following summary⁵.

Mean Annual Rainfall (mm)			% of Rainfall during the Wet Season (May-October)		
Mean	Maximum	Minimum	Mean	Maximum	Minimum
1,492	3,000	762	90	95	81

The mean maximum rainfall in SA-3T recorded in Nakhon Phanom province is 1,851 mm/year and the minimum in Nongbua Lamphu province is 1,119 mm/year. The mean annual rainfall of every province in SA-3T is 1,492 mm/year. The data reveals that precipitation varies widely. Heavy rainfalls occur during May-October, with the percentage of rainfalls ranging between 86-93 or equivalent to the average percentage of 90% of the whole SA.

Runoff

The runoff data of SA-3T was compiled from the Inception Report, Formulation of Integrated Water Resources Management Plan for the Mekong River Basin. Details are shown in the following table.

Unit: million cu.m.

Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Wet Season	Dry Season	Total
119.7	574.1	2,627.1	4,420.7	7,500.8	7,395.6	2,664.9	590.4	251.9	132.0	100.4	97.2	25,183.2	1,291.5	26,474.7

⁵ Master Plan Study for Increase in Water Resources and Water Use Efficiency by Grid System in the Northeast, the Mekong River Basin in the Northeast, Department of Energy Development and Promotion, Ministry of Science, Technology and Environment, June 2001

Soils and Land Use

Soils

Coarse soils of low fertility are typically found in the Mekong River Basin. They are shallow and gravelly, and also saline in certain areas. The soil characteristics and problems are highly relevant to the topography; therefore, soil series in the study area are classified according to the topographical conditions as follows:

Soils derived from alluvial deposits on the lowlands along the river channel and in narrow valleys are found on channel boundaries in parallel to the watercourse. They are sandy to sandy loam, well drained and deep with moderate to low fertility. The soils in the low-lying and flood-prone areas were derived from fine sediment deposits. They are deep, poorly drained soils with moderate fertility due to the regular sedimentation of natural fertilizer. Due to the poor drainage and water logging, these areas are used for rice growing. However, in the years when heavy rains and high flows occur, the inundation level will be high, thus causing damage to rice crops.

The low river terrace lying adjacent to the water logging areas is of slightly higher elevation and flat terrain. Normally, they are not subjected to floods except in the years of unusual high floods. Soils are coarse to coarse loamy, deep, and poorly drained with low fertility. The areas are used as transplanted paddy fields. On the low terrace, certain uplands that are erosional remnants are observed. If the soils are of Maha Sarakham series, they are sources of salt, which seeps down to lower lands and causes soil salinity. Apart from this, salinity from the underground water also rises up to the top soils and expands over the area.

The terraces on higher elevations, i.e. middle and high terraces and low hill slopes, are composed of coarse soils and shallow gravelly soils with low fertility and high erodibility. Paddy fields are found on low-lying land. On the upland, upland crops are grown or scrub forest is observed.

Mountainous areas are mainly sandstone mountains. Cuesta is the main topographical feature characterized by steep slopes with large boulders and mostly under forest cover. On the other side, gentle slopes are found. Soils, derived from sandstone, are coarse and shallow. Forest clearing has been practiced for crop or rice cultivation. The soils are highly erodible and fertility rate is low.

Land Use

Agricultural land is prevalent in this SA, especially paddy fields. Upland crops commonly grown are drought-resistant types and need low labour input, e.g. sugar cane, cassava, maize, sorghum, and beans. Vegetables and fruit trees are grown only in areas where water is plentiful and available all year round such as land along the river banks, and downstream areas of large dams. Common crops are tomato, chili, shallot, garlic, vegetables, papaya, banana, mango, and tamarind. Tree crops commonly grown are of fast-growing types, e.g. eucalyptus, wattle, Thai copper pod, and neem tree. Paddy fields and field crop cultivation are the major land uses in this SA.

Forest Resources

- 1. Forest Area:** Forest ecology in SA-3T is based on the assessment of forest potential by GIS and monitoring of changes in forest cover conducted by Forest Resources Analysis Division, Forest Office, Royal Forest Department in 1997. The Northeast Thailand's part of the Mekong River Basin is covered with non-deciduous forests in moderate to low density, especially in Phu Kradung and Phu Rua national parks, Loei province; Phu Phan national park, Sakon Nakhon province; and Huai Huat national park in Sakon Nakhon, Nakhon Phanom and Mukdahan provinces. Deciduous forests are more evident in other provinces, normally in small areas spatially located in the SA. The collected data on forest resources represents only part of the SA-3T, with the following details.

Loei is the province with the highest forest cover, with a total area of 2,889 km², followed by Udon Thani covering 1,847 km², Sakon Nakhon covering 1,362 km², and Mukdahan covering 1,331 km². Mukdahan is the province with the highest ratio of forest area to the total provincial area (30.67%), followed by Loei (25.29%), Udon Thani (15.74%), and Sakon Nakhon (14.17%).

From 1993 to 1998, the forest area coverage has declined in every province. The main cause is forest encroachment for agricultural land. Besides, denuded forests are found in some areas or in the cleared forest areas. If preventive and conservation measures are not stringently enforced in the future, forest areas will continue to decrease.

The highest decline in forest cover is observed in Loei with a loss of 35 km², followed by 34.5 km² in Udon Thani, and 19.8 km² in Nong Khai. Diminishing forest cover is also evident in other provinces, but not at a high rate. Details of forest areas in SA-3T are given in Table A-1 of Appendix A.

There are 17, 16, and 18 forest reserves in Nakhon Phanom, Sakon Nakhon and Mukdahan provinces, respectively.

- 2. Forest Conservation Area:** Various classes of forest conservation areas were established aiming at flora preservation, and recreation. Wildlife conservation and protection areas were established in accordance with the National Park Act, 1961 and Wildlife Conservation and Protection, 1992, e.g. wildlife preservation areas in national parks, and wildlife sanctuaries. There are wildlife preservation areas in national parks, and wildlife sanctuaries in SA-3T as follows:

Nine national parks have been established:

- 1) Phu Kradung, Loei, with a total area of 34,812 ha. (announced in November 1962);
- 2) Phu Rua, Loei, with a total area of 12,084 ha. (announced in July 1979);
- 3) Phu Phan, Sakon Nakhon and Kalasin, with a total area of 66,470 ha. (announced in November 1972 and amended in October 1982);
- 4) Huai Huat, Sakon Nakhon, Nakhon Phanom, and Mukdahan, with a total area of 82,856 ha. (established in July 1988);
- 5) Mukdahan, Mukdahan, with a total area of 5,076 ha. (established in December 1988);

- 6) Phu Hin Rong Kla, Loei and Phitsanulok, with a total area of 29,100 ha. (established in July 1984);
- 7) Phu Pha Man, Loei and Khon Kaen, with a total area of 32,597 ha. (announced in December 1991);
- 8) Phu Kao-Phu Phan Kham, Udon Thani and Khon Kaen, with a total area of 32,200 ha. (established in September 1985); and
- 9) Phu Sa Dok Bua, Mukdahan, Yasothon, and Ubon Ratchathani, with a total area of 23,200 ha. (established in 1989).

Three wildlife conservation areas were established, namely,

- 1) Phu Luang, Loei, with a total area of 89,695 ha. (announced in October 1974);
- 2) Phu Wua, Nong Khai, with a total area of 18,650 ha. (announced in May 1975); and
- 3) Phu Si Than, Mukdahan and Kalasin, with a total area of 31,400 ha. (announced in June 1990).

Three wildlife sanctuaries were established, namely,

- 1) Bueng Khong Long, Nong Khai, with a total area of 1,094 ha. (established in December 1982);
- 2) Nong Hua Khu, Udon Thani, with an area of 11 ha. (established in March 1985); and
- 3) Tham Pha Nam Thip, Roi Et, Kalasin, and Mukdahan, with a total area of 24,199 ha. (established in July 1988).

Wetland

Wetland is an ecological system which is diversified, linking lands and water bodies. It is a productive area where people may utilize for various purposes. Many countries do recognize the value and importance of wetlands that are located worldwide and accordingly, did agree on 13 September 1998, an agreement for conservation of wetlands known as Ramsar Convention in which Thailand was also a member country.

There are two wetland sites in SA-3T known internationally. Their respective locations and conditions are explained in the Table below.

Name	Location	Importance		Conditions
		Int'l	Nat'l	
Kong-long Hunting Prohibited Forest Area	Se-ka and Beung Kong-long Districts, Nong Khai	✓	-	<ul style="list-style-type: none"> - A big swamp of 10-km long and a width of 1.5 km.; deep water in the southern part, with high bank. Shallow in the middle part but plenty of water plants. - In the swamp, there is a big island of approx. 40 ha and four other small ones. - Water plants include lotus, water lily, sedge, hyacinth and many kinds of grasses. - Around the swamp are agricultural lands - Various water birds and ducks - Many kinds of birds, e.g., shelduck, - Area in the middle of the swamp is just like a tropical forest where birds and other animals can lay their eggs...
Nong Hua-Khoo Hunting Prohibited Area	Ban Pheu District, Udon Thani	-	✓	<ul style="list-style-type: none"> - A small swamp with water all the year round - Surrounding are paddy and forest (about 12 ha) areas - Water plants are sedge and others of similar nature - Some 2,500 birds, particularly ducks of various kinds, live in the area.
Lower Ming Basin	Sri Chiang Mai and Tha-Bor Districts, Nong Khai	-	✓	<ul style="list-style-type: none"> - A lowland along the banks of the lower Mong river - There are some 17 ponds with the size varying from about 10 to 280 ha. - The area is an important mating place for both the local and migrated birds using the Mekong as their main route.
Nong Harn	Muang District, Sakon Nakhon	✓	-	<ul style="list-style-type: none"> - A large swamp of about 13,000 ha, with a depth of about 1.9 m on the average. Parts of the area paddy fields and grass lands. - One of the largest natural water resources in the country. - Plants in the area include hyacinth, water lily, water lettuce, etc. Surrounded areas are light forest, agricultural lands and village communities. - Some 44 species of fishes, e.g., snake head fish, catch fish, etc., and many local birds live in the area.

Economics sectors

Watershed Management

Classification of Watershed

The Cabinet has endorsed on 27 July 1992, classification of watershed in Thailand that was divided into five (5) classes in accordance with their respective hydrology and natural resources and for effective management of the basins, with the following details.

Class 1 area is further divided into two: Classes 1A and 1B. Class 1A is to be preserved as upstream watershed of a river and therefore, all activities that could affect conditions of the forest therein are strictly prohibited.

For watershed Class 1B, if unavoidable, responsible agencies are required to conduct EIA of the project and to report the outcome to the National Environment Committee (NEC) for consideration prior to the implementation. In the case where road or mining is to be constructed/implemented in the area, the agencies are required to make a proper control over soil erosion that could be caused by such the activity.

Class 2 area is meant to be conserved basically for forestry and mining purposes, with a restricted rule over “land-use” in the area. The use of land for agricultural purpose is to be avoided.

Class 3 area can be used for activities related to forestry, mining, agriculture and other purposes, with some specific rules to be observed for land and water conservation.

Class 4 area can be used for all activities. For agricultural use, however, slope of the area should not exceed 28% and, there is a need for land-use planning in accordance with land and water conservation.

Lastly, for Class 5 area, it can be used for all activities.

This sub-area is considered a border river basin endorsed by the Cabinet. The terms “border river basins” were defined by NEC and submitted for the Cabinet’s consideration by the Ministry of Science and Environment on 21 February 1995 (OEPP, 1996).

In classifying this sub-area covering the total area of 46,367.5 km² (slightly differs from what has been referred to earlier due to the different source), it was found that watershed area of Class 5 constitutes the largest, i.e., 25,989.8 km². or 56.05%, followed by Class 4: 10,576.8 km² (22.81%). Class 1A which is to be preserved as upstream watershed area is about 1,072.5 km² (2.31%), located partly in upstream area and other in downstream one, see more details in the table below.

Land Classification in SA-3T

Classification	N.E. Mekong Basin	
	Area (km ²)	percentage
1A	1,072.49	2.31
1B	3,562.84	7.68
2	2,181.33	4.70
3	2,984.15	6.44
4	10,576.84	22.81
5	25,989.85	56.06
Total	46,367.50	100.00

Source: Watershed classification in GIS, Dept. of Pollution Control, 1997

Irrigated Agriculture

General condition

SA-3T is mountainous area in general, with some flat lands along the hills and valley. Some places are gently undulated, with lowlands in the middle. Therefore, local farmers will plant their crops selectively in accordance with the different topographic conditions, e.g., growing rice in the lowland areas and upland crops, vegetables and fruit trees in a higher lands.

Similarly, farmers in SA-3T grow more of glutinous rice than the non-glutinous one, because the people generally consume glutinous rice. Favorite rice varieties include RD6, RD8 and RD10. The major non-glutinous rice variety is Dok Mali 105, whose average yield is about 2.06-2.75 t/ha.

Favorite upland crops in the area are maize (with an average yield of about 2.5-3.25 t/ha), groundnut (an average yield of about 1.32-2.06 t/ha), cassava (an average yield of 12.5- 15.62 t/ha) and sugar-cane (an average yield of about 31.25-56.25 t/ha).

Fruit trees include mango, tamarind, rubber and banana. Other important vegetables and their average yields are chilli (6.25-12.50 t/ha), water melon (12.50-25.00 t/ha), sweet corn (6.25-12.50 t/ha), cucumber (8.75-16.88 t/ha) and string beans (6.25-12.50 t/ha).

Irrigation

Water resources development projects of various sizes have already been constructed in the area. Basic definitions of projects of different scales can be briefly introduced hereunder.

- 1) Large scale projects mean those with reservoir capacity of more than 100 MCM or, with reservoir area of more than 15 sq.kms or, with irrigation area of more than 80,000 rai (12,800 ha).
- 2) Medium scale projects means those with reservoir capacity of less than 100 MCM but more than 2 MCM or, with reservoir area of less than 15 sq.kms or, with irrigation area of less than 80,000 rai (12,800 ha) but greater than 3,000 rai (480 ha).
- 3) Small scale projects means those with reservoir capacity of less than 2 MCM or, with irrigation area of less than 3,000 rai (480 ha). Most of them are projects constructed by RID.
- 4) Pumping irrigation schemes are those projects that do not have reservoirs. They rely on water from natural rivers/streams that would be pumped up and delivered to beneficiary areas.

The size of agricultural land in this SA is about 2.37 million ha. Of the total, irrigated area is 0.30 million ha, equivalent to 12.73% of the total agricultural lands or 6.49% of the SA size. Lowland area is thus limited and not highly appropriate for development.

There are two large-scale projects in SA-3T, namely, Nam Oon Irrigation Project in Sakon Nakhon province, with the irrigated area of 29,728 ha and, Huai Luang Irrigation Project in Udon Thani, with the total irrigation area of 13,918 ha.

In addition, there are some 90 medium-scale⁶ projects, with the total irrigation area of 71,322 ha and 1,138 small-scale projects, with the total irrigation area of 102,168 ha. For the last category of pumping irrigation scheme, there are 326 projects, with the total irrigation area of 84,437 ha.

Demand for irrigation water

The demand for irrigation water⁷ in the sub-area represents the largest of all, i.e., with an estimated figure of 1,167 MCM/yr. Of the total, the demand quantities in the wet and dry seasons are 1,046 MCM and 121 MCM, respectively.

Water supply for domestic and industrial consumption

Data related to water demand for domestic uses and tourism industry were could be collected from various sources, such as, records on water consumption rates compiled by the RWO, the standard rates used in the survey of basic necessity, etc. On the basis of these rates (criteria), it is estimated that in 1998, the demand for water for domestic uses and tourism industry of SA-3T could be as much as 133.15 MCM.

Water demand for industrial uses of the sub-area in 1998, on the other hand, was estimated at 25.25 MCM.

Hydropower

Hydropower is relatively of non-significance to SA-3T due to unfavorable topographical conditions of the natural resources. The only major scheme in the sub-area is the Nam Phung (hydropower) Project. No other development potential is considered.

Flood Management

A vast area of this SA-3T is wetland that is normally covered with flood throughout the rainy season and beneficial for fisheries. In the dry season, however, part of the land can be used for growing rice and other short-duration crops. A reasonable flood level, therefore, can be very useful. However, similar to the previous case, many newly constructed infrastructures have caused heavy floods in the area.

⁶ 1998 data

⁷ Master Plan Study for Increase in Water Resources and Water Use Efficiency by Grid System in the Northeast, the Mekong River Basin in the Northeast, Department of Energy Development and Promotion, Ministry of Science, Technology and Environment, June 2001

Fisheries

Types of fisheries

There are two major types of fisheries in SA-3T:

- 1) Fish culture in earthen ponds located far away from the Mekong and its tributaries, depending only on rain-water;
- 2) Fish-cage culture on the Mekong and its tributaries, e.g., Nile tilapia. Decreasing water level of the Mekong often causes a problem of fertility of fish-feed in the river. There is no problem, however, in the wet season when the flow is abundant.

One of the most important fish resources in lower Nam Song-khram basin, which is internationally known as an important wetland with a total area of over 80,000 ha (only next to the Tonle Sap in Cambodia). Fishing in the area has been on a change from fishing for home-consumption in the past to commercial fishing at the present in which advanced and often wrong-use of fishing gear is being observed.

Fish resources

An annual average of fish production in this sub-area is in the range of 36.88 and 70.00 kgs/ha. Number of fish species found in water resources of the basin are between 6 and 22. Year-round average ratios between herbivorous species and carnivorous ones are 1.6-2.1, which are lower than desirable fishery levels in natural water resources (which should be 3-6).

Navigation

Presently, there are only cross-haul transportation between countries. In addition to ferries, there are boats for tourists operating in the Nam Song-khram and the Mekong near Nakhon Phnom. There is no major channel improvement activity for navigation but, some small activities to help maintain conditions of the main river and other stretches required by local authorities, after taken into account their engineering social and economic aspects.

Existing problems related to bank erosion caused by meandering nature of the river. Other causes of the bank erosion include those of human activities (e.g., sucking sand from the river, construction of structures in the river, etc.) and a rapid decrease of water level in the river.

Conceivable solutions to the problem are bank protection schemes at critical sections where erosion rate is high and the environmental social and economic justifications thereof are sound.

Tourism

Thailand is a hub of tourism in the Mekong sub-region⁸. In 1996, the

⁸ The development of the Mekong River route in Mekong sub-region, Thailand Tourism Authority, 1998

number of tourist making visit to Thailand was 4,303,000 persons or, 68.31% of the total tourist number visited the region in that year. Most of these tourists came from countries in East Asia and the others from Europe, America, Osiania and South Asia.

Considering development strategies of the provinces in SA-3T, it was found that all the provinces attach great importance to tourism. Efforts were put in PR activities as well as training of people to accommodate the increasing need in this sector. SA-3T promotes eco-tourism that relate closely to life or the way of living of the local people, which is the strength of the area. In the near future when the 2nd Mekong Bridge at Mukdahan is completed, it is expected that tourism industry will be even more enhanced, covering tourism activities that linked to the Lao PDR and Vietnam too. To meet with this anticipated changes, both the Government and private sectors will need to prepare themselves for a favorable development that is going to take place in the region.

Important touristic places in SA-3T that linked to the Mekong river are Chiang-khan and Pak-chom districts of Loei province. In 1996, number of the tourists has reached 139,986 persons or, 3.25% of the total number of tourists visited the Mekong sub-region in the same year. Most of the tourists, however, are Thai national. About 10% of the tourists visited the area in December and January, which is winter. Attractive spots include rapids at so-called Kang-Kud-Koo at Chiang Khan and ways of living of the Thais and the Laos who live along both banks of the Mekong river.

Also in 1996, number of the tourists visited Nong Khai was 861,000 persons, or 20.01% of the total tourists who visited Thailand and along the Mekong river in that year. Of the total, 8.45% was tourists from abroad and the remainders were Thais. Favorite touristic spots included Tha-sadej, the Thai-Lao Friendship Bridge and Bho-chai Temple. Tha-sadej is a particular spot for sight-seeing on the boat. Some 80% of the tourists will make a visit to this place to watch boat racing and other local festival organized regularly at the end of each rainy season.

Environmental issues

Watershed Management

The problems related to watershed management in SA-3T can be summarized by provinces as following.

Province	Types of problems
Loei	<ol style="list-style-type: none">1. Deteriorating forest resources and encroachment problems2. Damaging water quality in the river3. Soil erosion along the river's banks
Nong Bualamphoo	<ol style="list-style-type: none">1. Deteriorating forest resources and encroachment problems2. Soil erosion problem3. Damaging water quality in the river
Udon Thani	<ol style="list-style-type: none">1. Deteriorating forest resources and encroachment problems2. Damaging water quality in the river3. Problem on salined soils
Nong Khai	<ol style="list-style-type: none">1. Deteriorating forest resources and encroachment problems2. Soil erosion problem3. Bank erosion of the Mekong river4. Damaging water quality in the river5. Expansion of salt water and salined soils
Sakon Nakhon	<ol style="list-style-type: none">1. Deteriorating forest resources and encroachment problems2. Damaging water quality in the river3. Soil erosion problem4. Bank erosion of the Nam Phung river
Nakhon Phnom	<ol style="list-style-type: none">1. Deteriorating forest resources and encroachment problems2. Damaging water quality in the river3. Bank erosion of the Mekong river
Mukdahan	<ol style="list-style-type: none">1. Deteriorating forest resources and encroachment problems2. Damaging water quality in the river3. Soil erosion problem
Amnat Charoen	<ol style="list-style-type: none">1. Deteriorating forest resources and encroachment problems2. Damaging water quality in the river3. Soil erosion problem4. Bank erosion of the Mekong river

Irrigated Agriculture

- Scarcity of water during some dry-spell periods
- Poor soils, mostly are sandy soils and well-drained
- Expansion of salinity soils and water
- Productivity is generally low
- Lack of proper management and continued maintenance of irrigation infrastructures, particularly weirs
- Inadequate distribution system for crop areas
- Un-attended electrical pumping system leading to low efficiency in utilization

Water supply for domestic and industrial consumption

- Salinity water, poor quality and not appropriate for waterworks
- Deteriorating condition of water resources, e.g., the case of Nong Harn
- Inadequacy of village waterworks

Flood Management

- Many newly developed infrastructures (such as roads and bridges) become obstacles for navigation/river-borne transportation that used to be practiced in the sub-area.
- Swamps and ponds in the area became shallow.
- Lack of proper management practices on water.

Fisheries

- Natural fish population decreased drastically
- Fishing practices that exceed potential, the use of prohibited fishing gears
- Weakness in law enforcement
- High cost of fish feeds for fish culture
- Construction of dams or weirs that obstruct the migration and spawning of fishes (ref. the case of constructing dike around the Nong Han)

Analysis

Development opportunities, needs and constraints

I. Development opportunities and needs

Watershed Management

Existing upstream area of 3T is a deteriorating forest resources be continuing further in every province. Meanwhile, the current conservation of head water resources campaign is spread widely. Thus the government agencies and local administration starting to cooperate with communities surrounding forest to rehabilitate forest area is more feasible. The development and conservation can be applied together in the same time. Hence, agro-forestry and sustainable agriculture will be promoted particularly in the upstream watershed to reduce firewood used from natural forest and build up income to local people. The pilot area now starting in Phu-Phan range, Phu-Sithan, Phu-Wua and Phu-Singh by strongly public participation.

Sustainable development should not be succeeded if the local people are not encourage and low supporting from government agencies then, building-up the sense of responsibility within educational institutions and establishing community network in upstream will also be promoted.

Any development can not be succeeded if no cooperate with the people in area and not link to their community benefit especial forest conservation area. If local people who have life relate to forest can not be participated to use their resources that they not concern to protect the forest. Hence, communities' forest is the alternative to manage by local people and required public participation in protecting and utilizing their resources. Firewood is continuing used by local people who live surrounding forest, to conserve forest then re-forestation (at household and community levels to reduce consumption quantity) and continued management/maintenance in 3T sub-area.

In steep slope upstream area soil erosion affected to downstream area, cause flash flood in wet season and sedimentation problem to reservoir. National Park, Wildlife and Plant Conservation Department has project participate with local people to construct weirs to retard water flow, which will facilitate conservation of land resources upstream and reduction of sediment downstream.

Irrigated Agricultures

Mostly, agricultural area in 3T is monoculture which used high chemical substance affected to farmer health and environment. The integrated agriculture system is cultivated with multi-plant in the same area should be introduced to decrease chemical use.

The previous water allocation system managed by Royal Irrigation Department (RID) and had lower participate from the farmer to save water. RID established water users' group in many irrigation area but moving slowly

then promoting establishment of water users' group, to encourage people's participation in sub-area 3T water management.

There are no site to construct large reservoir in sub-area 3T which limit water sources for irrigation. The alternative to manage the same water quantity for irrigation area as maximize benefit is improvement of irrigation efficiency. Many appropriated technology should be applied and required participation from farmer.

Practically, farmers in 3T sub-area try to manage water quantity in their area to be used for agriculture in dry season. They can cultivate rice and preferable plants in wetland then integrated development of irrigated agriculture in wetland areas should be promoted (which are desirable to life of the local people).

Water Supplies

The highly economic growth affects to the change of land use, thus the measures of zoning land use is necessary such as community, industrial, agriculture zone in order that water allocation plan may be put in place and waste water from the industries can be treated and put under control.

Water supplies is the common service standard serve to people, the government policy targeted to quality water for domestic uses at least at the rate of 50 l/h/d by means of increasing number of village waterworks, improving the existing ones to enable them to produce the water of standard quality. The existing water resources are deteriorated from many activities then raw water to produce water supplies is decrease. In the future when the economic growth rapidly, the Mekong sub-region water resources should be protected qualitatively and quantitatively to meet adequate requirement. Long term plan should be set up to reduce the use of agro-chemical substances and the release of their waste directly to water resources by means of the establishment of water treatment plant in people's community. Also, discourage establishment of large-scale industries that will affect quality of water in sub-area 3T. In rural area, raw water is pumping from groundwater with low water quality hence, the use of mountain water supply in stead of groundwater should be encouraged.

Flood Management

As the economic and social development plan in Thailand the government agencies response for flood management after the new constitution 1997 gave authorities to people to participate in managing, conserving and utilizing natural resources and environment in sustainable manner. Flood problems affected by many factors and need to be solved based on the real causes, so not only government agencies to mitigate and manage of flood but also public participation is required working together with government agencies. Many activities are required such as enhance knowledge and understanding, study local conditions, exchanges of data/information, analysis of the data for beneficial uses, etc.

Flood problems in 3T sub-area affected from development. The definition of flood was changed when the wetland area developed to resident area. For the sustainable basis flood management needs base on community participation to prepare a master plan. Arrangement should be made to allocate budget to local administration or communities. The pilot area study should be set up and the topic of study on water management following a network system in Nam Kam. In practically local agencies dredging channel to improve flood draining system every year, the suggestion from 3T participants workshop presented that improvement system should take into account environmental impact.

Fisheries

3T sub-area has significant fisheries activities compare to the other sub-areas, Nam Songkram is the specific river produce high fisheries product every years because no infrastructure obstruct fish migration in the River. Sustainable fisheries development in 3T sub-area should be promoted details are as follow:

- Promotion the establishment of fish conservation zones with communities' participation in doing the management;
- Encourage the establishment of communities' own rule to help solve the problems and management of fishery resources at local level;
- Promoting rehabilitation and conservation of swamps/ponds, e.g., one community one swamp;
- Revive Buddhism Culture, e.g., no fishing on the Sabbath Day;
- Promoting studies/researches on community-knowledge, e.g., a research on village life in Nam Songkram basin;
- Promoting fish-cage culture in areas where there are flows, such as along the banks of the Mekong River.

Existing fish stocking produce by Fishery Department or agriculture firms then local people need to increase capacity of the Fishery Department as well as the communities in producing fingerings for the release in to natural water bodies. The idea from participants in 3T sub-area is pro-active to feeding multi-fishes in floating basket which advantage more productivity than monoculture. The main cost in aquaculture is feed hence the fisheries need the developing or managing to secure cheap feeds.

Potential social, environmental and economic impacts of development

Consider to above mention two groups of provincial strategies in SA-3T there are three strategies will be affected to social, environment and economic such as agro-industry, cross border trade and tourism. These strategies support to the future development trend in Thailand and also link to the regional development especially, east – west corridor in Greater Mekong Sub-region.

For SA-3T, priority is given to watershed management, environment, and fisheries sectors. They are closely interwoven with the way of living of the inhabitants in the river basin, especially Nam Songkhram River - the only river where structural development is still limited. Many rivers rise from the watershed area and then flow to downstream wetlands, which are habitats and spawning areas of fish, and also the important sources for local fisheries.

Of particular note is the community network involving in watershed preservation and emphasizing the importance of watersheds by organizing continuous activities. This should be strengthened and a pilot project may be initiated, e.g. Phu Phan area: study of environmental changes of Nong Han, Sakon Nakhon, etc.

Another sequential activity is ecotourism that should be in harmony with the people's way of living. The existing tourism should be enhanced and promoted with greater emphasis on quality of tourists rather than quantity.

Potential transboundary/cross-regional issues and impacts

In an overview, the future development of SA-3T will be in line with the strategies of provincial groups by optimizing the strengths of each province. Each province manifests its direction, e.g. Sakon Nakhon focusing on human resources, Nakhon Phanom and Mukdahan on tourism and Indochina trades, respectively. Moreover, inter-provincial collaboration is encouraged within the groups. The development under the BDP context should also correspond to this framework, e.g. collaborative learning approach on watershed management to ensure adequacy of water resources for dry-season cultivation and water supply for the local people's consumption.

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